Founded 1874—Fifty-Two Years of Service

Electrical World

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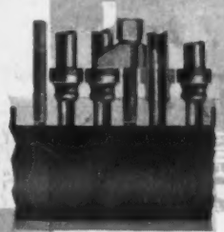
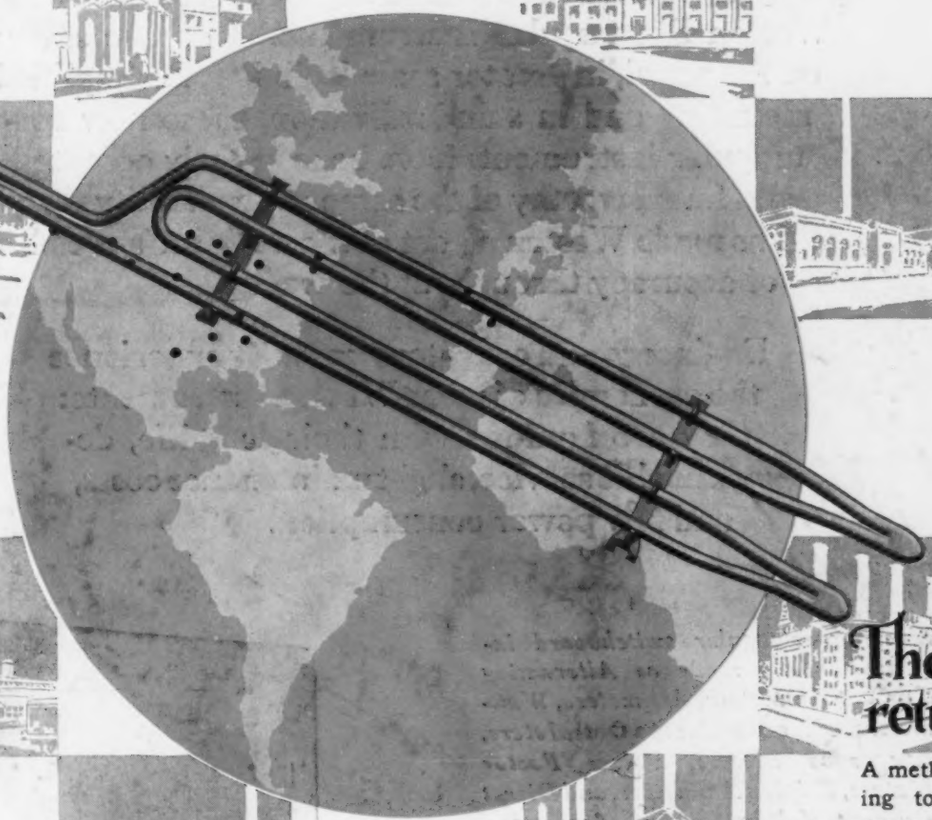
The ball joint

A metal-to-metal contact—flexible, remains tight under most severe operating conditions, easy to adjust and maintain.





The forged return bend

A method of joining tubing to permit lengths, arrangements, heating surfaces and uniform steam flow areas most advantageous to the design of superheater units.

On this page are sketches of a few of the more recent large central stations that have installed Elesco Superheaters, such as—Hell Gate—River Rouge—Sherman Creek—Barbados Island—Devon—Sterlington—Middletown—Toledo Edison—Colorado Springs—Pine Bluff—Illinois Power, etc.

Determining factors were: Elesco Engineering—Elesco Forged Return Bends—Elesco Ball Joints—Elesco Service Records.

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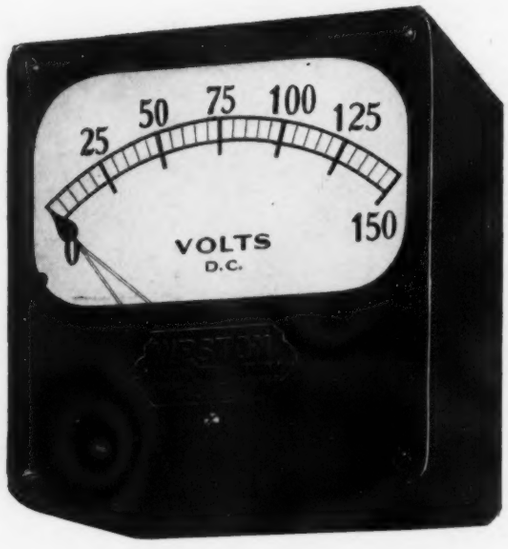

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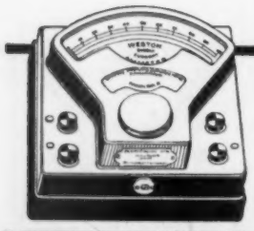

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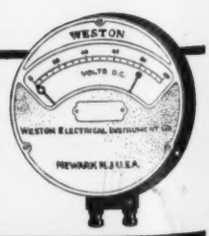

Electrical World

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W. H. ONKEN, JR.
Editor

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An Electrical League of Nations

AS WE go to press the plenary meeting of the International Electrotechnical Commission, assembled in the United Engineering Societies Building in New York City, is coming to a successful close. A technical account of the sessions will be concluded in the next issue, and we wish here merely to extend heartfelt greetings to the delegates from across the seas and to point out to our readers the great significance of the work of the commission. Organized at London, following the engineering congress in connection with the world's fair in St. Louis in 1904, the commission has functioned ever since and has contributed much to a clear and definite understanding of specifications, tests, guarantees, tolerances, temperature rise and other matters pertaining to electrical machinery and apparatus. As a result of its work users of electrical apparatus in countries which do not produce it themselves may rest assured that machines, conductors and other electrical apparatus offered by makers in the principal industrial countries of the world conform to the requirements of efficiency, safety and long life internationally agreed upon. Unfair competition is being eliminated as much as possible, so that, for example, a 10-hp. motor with a standard temperature rise gradually begins to mean the same thing throughout the world. The work of the commission will never be ended. In fact, it grows with the progress of the art, helping both the makers and the users of electrical machinery to know definitely what they may expect in the world's markets.

Any one who has attended even one session of the commission cannot help to be impressed with the potency of its work in promoting good will among nations. All the elements of difficulty which enter into the activities of the League of Nations are present in the work of the commission, only on a smaller scale. National aspirations, inability to see other men's points of view, fear of being taken advantage of, difficulties arising from definite instructions, failure to grasp the fine points of a foreign language in which decisions are put, the virtually unanimous consent necessary for every small ruling, the geographical scattering of representatives between the meetings—these things slow down the work. On the other hand, much broadmindedness and even "world-mindedness" has been shown—a sincere desire to yield a point for the sake of unity, or a tactful recognition of the justice of a claim made by a nation which is a commercial competitor. If there were similar commissions dealing with, say, twenty principal sources of international rivalry, the work of the League of Nations would not only be greatly simplified, but much friction and jealousy would be taken out of it.

The electrical profession in this country may look with some pride upon the present prosperous and harmonious state of the commission, not only because of its inception in this country, but also because several of our prominent engineers took a conspicuous part in its early struggles for recognition and in its precarious existence during the war and during the period of re-establishment of international relations afterward. Among the faithful workers we shall mention Dr. C. O. Mailloux, the honorary president of the commission, and Dr. A. E. Kennelly.

The Southwestern Convention

THE spirit of fellowship which exists in the electric light and power industry was very well exemplified in the convention of the Southwestern Geographic Division of the National Electric Light Association held in Galveston, Tex., last week. That division is made up for the most part of the smaller public utility companies of Arkansas, Oklahoma, Mississippi, Louisiana and Texas, states whose great open spaces appeal to the adventurous spirit of youth and where men must rely more on their own resources. Naturally, when such a group of men get together enthusiasm abounds. Grace, poise and mature judgment may not be so apparent; but that is only because the determination and the will to go and get is uppermost. The Southwest is growing rapidly, and to keep pace with the tremendous growth calls for that impetuosity of strength and courage inherent in youth which vitalizes not only that newer country but the expanding utilities serving it. Staleness cannot overtake an industry or a section animated with the enthusiasm and comradeship manifest in the Southwest. There the men and women of the industry work hard and play hard and the combination works wonders. This the Galveston convention revealed to a marked degree.

Bears and Bulls in Station Design

IN THE design of modern power stations there are at least two schools of thought. Briefly, one school contends that there is too often a tendency to strive for high efficiency without balancing its value against the resulting increase of investment, complications, operating difficulties and possible maintenance charges. Furthermore, the designer is generally too optimistic regarding the useful life to be expected of a plant and the capacity factor obtainable during that life. This school contends that it is not at all uncommon to see a high-capacity-factor base-load plant relegated to second place in five to seven years. Most such plants are built in installments, which means that only the units first purchased may be credited with five to seven years' useful life and that those installed near the end of the period must carry too heavy a charge against capital expenditure. This school believes that it is generally the wisest plan to design a plant for a lower thermal efficiency than initial consumption and calculations might seem to justify.

Another school adopts the attitude that with interconnection it is possible to operate stations at high load

factor. Some are already so operated. It should be possible to continue to operate them as base-load stations until they are superseded by more efficient ones. By designing a station for the load factor to be expected during the first seven or eight years it may be possible to justify only an efficiency which will make the plant obsolete in a short time because of later developments. To avoid plants becoming obsolete quickly, it is therefore believed better practice to design for higher efficiency than the immediate future load will warrant. In support of this argument it is pointed out that when it is considered that unit capacity, and consequently the unit space requirements and unit cost of boilers, condensers, coal handling and coal storage as well, are reduced by using more efficient units, the cost of modern power stations using 600 pounds pressure will be only slightly, if any, more than that of stations with pressures of 250 pounds to 300 pounds pressure. There are many large stations of modern pressure the cost of which exceeds that of existing 600-pound stations.

Some financier has said: "An engineer, to be a good business man, must be a bear on the future." On the other hand, many who are well acquainted with past progress and have an excellent perspective concerning the future of interconnection ask: "How can an engineer be a bear on the future of electricity?"

Thiolite, a New Composite Insulator

EVER since the discovery of bakelite it has been realized that it should be possible to create other similar types of compound possessing valuable insulating and dielectric properties. There has recently been presented before the French Academy of Sciences by M. André Samuel a report of such a new material. It is stated that in view of the property possessed by sulphur of improving the dielectric properties of natural organic materials it might be possible that the same result would follow in connection with synthetic materials. Following this idea, it has been found that a certain condensation product of formic aldehyde, when treated with sulphuric chloride, under certain conditions, leads to a remarkable dielectric substance.

In its initial form it is a white powder to which the discoverer gives the name "thiolite." It has no odor, softens at about 80 deg. C. under atmospheric pressure, and under the pressure of a few kilograms it fuses at 150 deg. C. without giving off any gas. In this condition it can be fabricated in extremely short time into molded shapes and strong vitreous structures. It is then hard and perfectly insoluble in all solids. In this state it is non-fusible, non-inflammable and does not soften under heat. It does not absorb humidity from the air and resists to a remarkable degree the action of chemical reagents. It is stated that samples constructed four years ago have shown no alteration whatever. The unheated powder is instantaneously soluble in a large number of organic solvents, such as alcohol, acetone, etc. In this way it is possible to manufacture varnishes which one can evaporate and then subject to heat treatment with rapid formation of the final substance. These varnishes are chemically neutral, very fluid, even in the concentrated state, and when dry have remarkable insulating power.

As an example it is asserted that a copper wire receiving a coating of this insulating liquid a few thousands of a millimeter thick and then subjected to heat treatment is so completely insulated that it may be electrified by friction, retaining its charge so as to attract light bodies as well as does amber. It is stated that the substance has a specific resistance of 3×10^{5} megohms, specific inductive capacity of about $4\frac{1}{2}$, and that its dielectric strength varies from 20 kv. to 90 kv. per millimeter for samples varying from 4 mm. to 0.1 mm. thick. These figures indicate very remarkable properties for this new substance. Further data as to its adaptability to and its performance in the problems of electric insulation will be awaited with great interest.

Committee Work Deserves Recognition

THE coming N. E. L. A. convention will witness the annual gathering of the light and power clan. Many notable addresses will be heard and much constructive work will be done at the convention, but it should not be forgotten that real work has been done also during the year. A ten-minute report by the chairman of a major committee gives little inkling of the vast amount of time and labor expended during the year by the committee members. Any one who attends the meetings of a major committee of the N. E. L. A., however, is impressed with the quality of the work done, the caliber and constructive attitude of the members and the effective organization of their work to secure definite results. This year, for example, one of the technical committees has produced eight major reports and has virtually completed three others. These reports were the work of the ablest sub-committee workers to be found in the industry and required a vast amount of time and labor for their development. Yet these men seriously and willingly worked at their daily jobs and in addition did their committee work for the good of the industry.

At a committee meeting of these men the procedure is to make decisions promptly and correctly. There is no lost motion and no idle talk. The whole atmosphere is tense with serious effort to get constructive results, and it would astonish many utility executives to witness the profound understanding and the precision with which these committees drive toward their objectives. They deserve whole-hearted support and the greatest thanks of the industry for producing invaluable information to better its operations.

An Outside Viewpoint on Sales

UNBIASED outside impressions of the electrical industry may often point the way to correcting shortcomings which those in every-day association with its operation are too close to see. During the course of a conversation recently a well-known banker unburdened himself of the following pointed observations:

"There can be no question of the inherent stability of the electric utilities—the diversity of their business enables them to operate profitably through slack periods as well as during unusual industrial activity. The power companies, however, are thinking in terms of finance and engineering rather than in service rendered. Lack of keen commercial acumen among the utilities is notorious. The head of a central-station company may be —usually is—a man of high technical and engineering skill, but his attention to and knowledge of salesmanship approaches nothing. Failure to sense possibilities of commercial development is preventing the entire electri-

cal industry from expanding much more rapidly than it is. And until the executive heads of these companies can see their way clear to hire and pay sales and advertising managers as much as or more than they now think they ought to pay an engineer the present status will continue."

This is not the first time that attention has been called in these pages to the inadequacy of central-station sales organization. But when it becomes so apparent that a disinterested observer can thus accurately analyze a condition it is time for the industry to take stock of itself. Huge power plants and transmission systems have been constructed in the expectation of increased demands for electric service. They constitute in reality an enormous manufacturing plant whose product is kilowatt-hours. Power companies cannot, however, expect the voluntary demand to keep up indefinitely. Sales volume is the true measure of success for any business, and until the central-station companies give as much attention to the marketing of electrical energy as they have given in the past to its production they will not enjoy the degree of prosperity and public appreciation of service rendered which should be theirs.

A Whirlwind Commercial Lighting Campaign

RESULTS of lighting campaigns conducted by progressive central-station companies continue to verify the contention of students of lighting that more artificial light is needed almost everywhere. They also prove that better lighting is readily sold and that the consumer of light is in a receptive mood. In this connection the recent activity of the Public Service Company of Colorado is extremely interesting. This company conducted a lighting school for a hundred of its representatives for the purpose of combined instruction in lighting principles and in commercial possibilities. The school was a forerunner of a series of lighting campaigns which C. A. Semrad, general commercial manager, planned to conduct through his able electric division manager, G. B. Buck.

The first campaign dealt with commercial lighting, and Mr. Buck turned his salesmen loose full of knowledge of lighting and of enthusiasm over the possibilities. Quotas were established beforehand for various divisions and individuals. In the first twelve days lamps rated at 655 kw. were installed in 3,012 commercial lighting units sold. These replaced lamps rated at 262 kw., making thus a net increase of 393 kw., or 150 per cent of connected load. This again confirms the contention that various fields are less than "half lighted."

It is a simple matter to compute approximately the increase in revenue to the central-station company. It amounts to many thousand of dollars annually from just twelve days' activity in one lighting field. But the by-products at this stage in lighting development are of particular interest. The lighting in hundreds of stores and shops has been raised to a better standard. These are now outposts of good illumination. By example they will raise the standard of lighting in their vicinity. These lighting installations will, in general, be operated more hours than the old installations they replaced. This is because they are effective for longer periods. As outposts of better lighting their influence will spread far and wide outside the commercial field into the homes, offices, factories and streets.

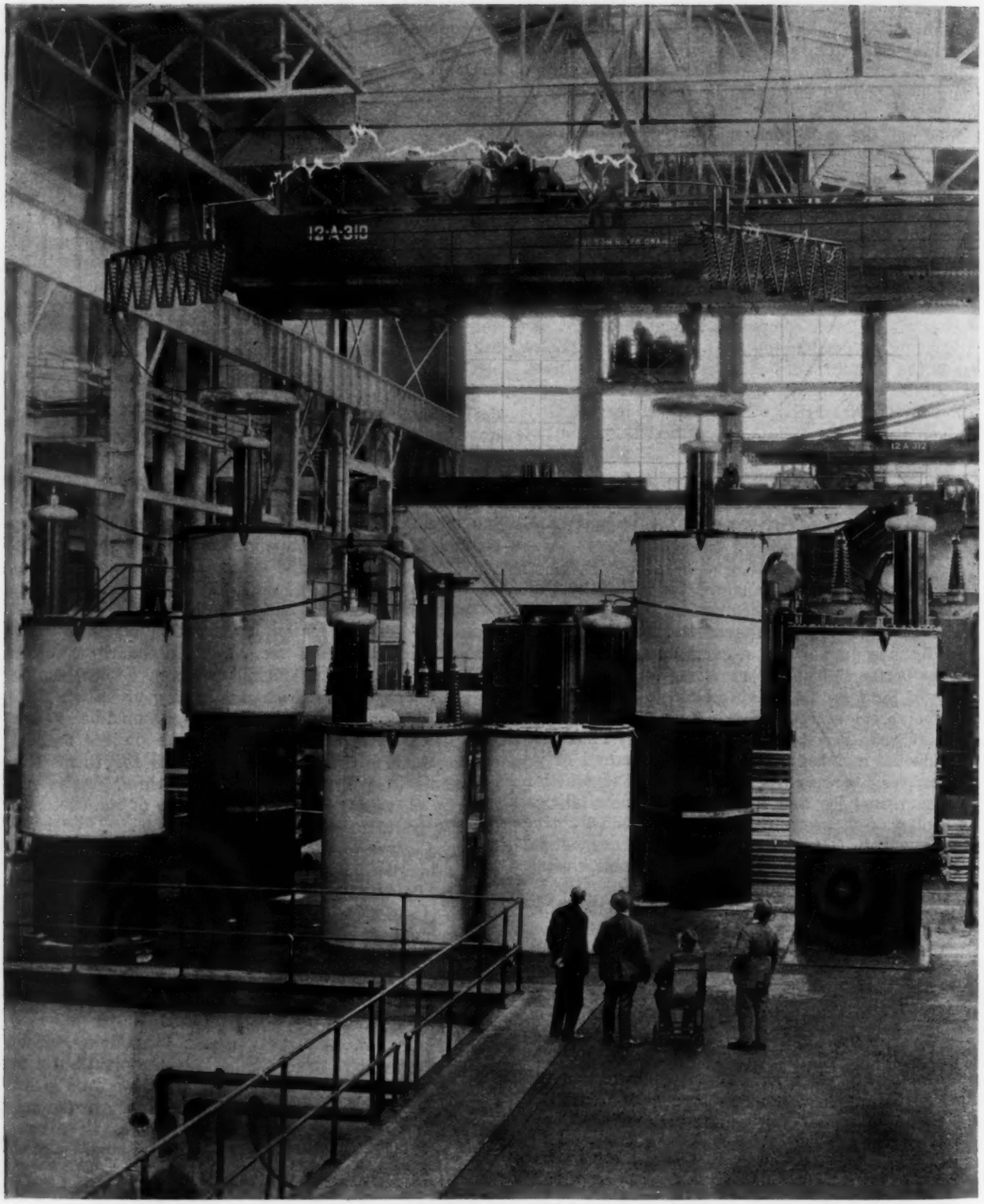
The lighting industry will not fail eventually to give full credit to progressive commercial men who are leading the way to much-needed better lighting everywhere. In the case under notice the quota for this commercial lighting campaign was 4,200 lighting units. In three weeks the sales exceeded the quota.

Service Versus Income

IT IS understood by the customers of an electric light and power company that the latter is not in business for its health and that it desires to sell as much energy as possible. At the same time, it is also understood by the customers that the company expects to do business with them for many years to come and that the interests of the consumer should be more than reasonably guarded. In other words, confidence and good will are worth many dollars of income and the business succeeds in the degree that these are earned.

A problem arises every time an improved electrical device is put on the market with power consumption less than its predecessor. If the operating company has figured out that to replace the old devices by the new would pay its customers, and if at the same time this would mean an appreciable cut in revenue due to a saving in energy consumed, should the operating company conduct a vigorous campaign in favor of the new device? To give a specific example, the new neon lamp, in the form of letters of the alphabet, seems to be quite effective in a certain class of illuminated signs. At the same time, its power consumption is much below that of an equivalent sign using standard tungsten lamps. Should an operating company do its best to induce its customers to change to new signs where to the best of its judgment such a change would be to their advantage, or should it follow selfish desires and let the customers discover the new signs for themselves and adopt them in the due course of time? As is evident by past experiences, the interests of the customer will always be considered paramount. This is exemplified by the use of the tungsten lamp to replace the old carbon lamp.

A similar situation arises with respect to manufacturers of electrical equipment. Two or three large makers may sometimes keep a desirable electrical device off the market because its introduction would cut down the revenues of operating companies, on account of the lower power consumption of the new device or because its use would involve replacements of equipments at a tremendous cost. Are they justified in so doing, either on moral principles or on the basis of the plain business wisdom of always giving the customer the advantage of new improvements and savings? With the rapid advance of the electrical art a consistent policy in this respect is desirable, and just as operating companies have not hesitated in the past to guide their policies by following customers' interests, so there is no reason why electrical manufacturers should not be guided by the same definite policy in this respect. A retail grocer is a go-between so far as the housewife is concerned, and she expects him to do certain things when the market changes or when farmers adopt a new policy. The situation is somewhat similar, and the customer of an electric company, who usually knows very little about electrical matters, should at all times look with confidence to electrical business leaders to protect his interests. This policy has proved to be good business for all concerned.



2,000,000-Volt Transformers for High-Voltage Transmission Problems

THE 2,000,000-volt six-transformer test set being built for the new experimental laboratory at Leland Stanford University will operate at the highest voltage ever produced at commercial frequency and will be used largely in the solution of high-voltage transmission problems. The set is designed for the so-called "chain connection," and by using various numbers of transformers experiments may be conducted at different voltages and conditions. Two of the transformers are insulated for 350,000 volts from the ground and two for 700,000 volts from the ground by insulating cylinders. Three of these cylinders will support one of the transformers weighing 45,000 lb. with a mechanical factor of safety of 12,000 per cent, though each cylinder is only 37 in. in diameter with a ¾-in. wall. The illustration shows the six transformers in chain connection operating at 2,100,000 volts in the Pittsfield plant of the General Electric Company, where they were built under the supervision of their designer, A. B. Hendricks. A spark between the needle points may be seen in the upper left-hand corner above the end of the crane.

Isolating Faults in Hudson Avenue Plant

Description of Scheme and Operation of Protective Equipment—Two Cases of Reactor Grounds Within Ten-Minute Period Put Relay System to Successful Tests—Sequence of Switch Operations Shown

By E. A. HESTER and L. B. BONNETT
Brooklyn Edison Company, Inc.

IN CHOOSING the protective schemes used in the Hudson Avenue generating station of the Brooklyn Edison Company the chief consideration was to provide for the complete isolation of a fault and to restrict it to the smallest possible area without going to extreme complications in equipment. Fig. 1, a one-line diagram of the bus layout for the first three units, shows the method adopted.

All outgoing feeders are equipped with induction type overcurrent relays, which are given settings dependent upon the requirements of the external system. Each feeder group bus is protected by induction type over-

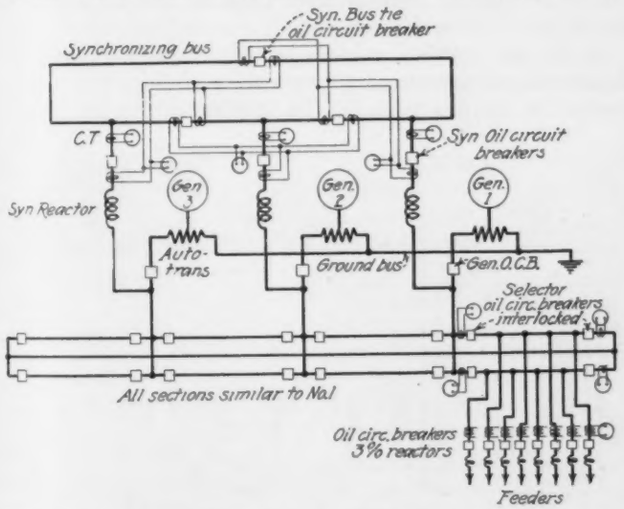


FIG. 1—DIAGRAM OF BUSES ON FIRST THREE UNITS AT HUDSON AVENUE PLANT, SHOWING PROTECTIVE SCHEME

current relays on the selector circuit breakers, which in addition act as a second line of defense in case of feeder trouble. Moreover, they are set in such a way that if the feeder reactor fails, the selector circuit breaker will open ahead of the feeder circuit breaker. This is made necessary because of the fact that the feeder circuit breakers are rated to interrupt only about 500,000 kva., whereas the selector circuit breakers have a capacity of 1,500,000 kva. Under most conditions a fault inside the feeder reactor will draw enough current to exceed the interrupting capacity of the feeder circuit breaker. The way in which this selection is made possible is shown by the curves in Fig. 3.

The synchronizing bus is in the form of a ring and is protected differentially. Each synchronizing circuit breaker and its two adjacent bus tie circuit breakers are balanced against one another, the current transformers in each case being placed outside the circuit breaker which they protect. Under normal conditions these three transformers in any phase are balanced and no current will flow in the relay. Upon the occurrence

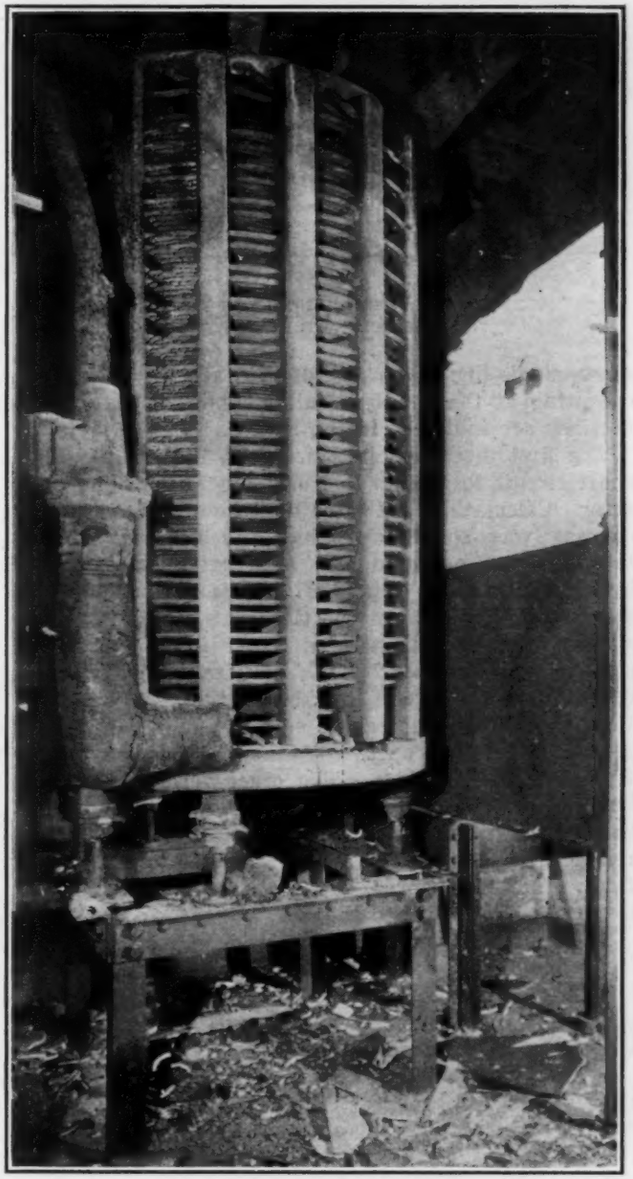


FIG. 2—THE REACTOR AFTER THE FIREWORKS

of trouble within this protected area, including the circuit breakers themselves, the balance is upset and all three circuit breakers are tripped.

In addition to this differential protection, each synchronizing circuit breaker is protected by an overcurrent relay that acts to free the synchronizing bus in case of trouble at any point between the selectors, generator circuit breaker and the synchronizing circuit breaker. Trouble in this area also disconnects the

selector circuit breakers through back-feed. This clears everything except the generator itself, which can be disconnected only manually.

In all cases settings were so made that if the circuit breaker adjacent to the fault failed to open, the one next in line would clear the trouble.

The Hudson Avenue generating station went into operation in May, 1924. The first short circuit within the station occurred on Aug. 25, 1925. Fig. 4A and B

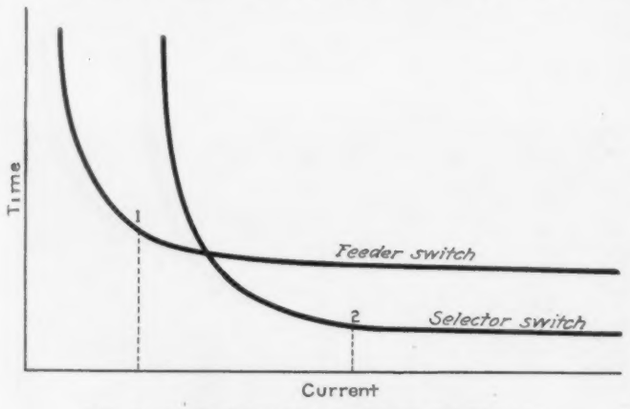


FIG. 3—TIME-CURRENT CURVES OF FEEDER AND SELECTOR SWITCH RELAYS

show single-line diagrams of the station as it was operating at the times of failure, and the actual connections are indicated in the legend.

The first disturbance occurred at 1:59 p.m. with a short circuit to ground in No. 2 synchronizing bus reactor. Calculations indicated that the total short-circuit current was so divided that synchronizing circuit breaker No. 2 operated first, and that it was followed by circuit breakers *E* and *F*. Since generator No. 2 was not in operation at the time, the opening of these circuit breakers cleared the trouble in so far as the station itself was concerned. Simultaneously with the operation of the circuit breakers in the generating station, the directional relays on the substation end of feeders 23 and 26 operated, thus clearing the trouble from system back-feed. The other feeders on No. 2 bus section were all connected to the substation buses through ungrounded transformers, and the directional relays at the substation were not affected by the ground fault. This sequence of operation may be followed through by referring to Fig. 4A.

At about 2:06 p.m., while the work of restoring service on No. 2 bus section was in progress, a second short circuit occurred in the same location as did the first one. This opened circuit breaker *H* as indicated in Fig. 4B and the fault cleared.

Service was interrupted on one section consisting of two four-feeder groups. Service on all other feeders was unimpaired. Because of the diversity of feeds to the substations, service to customers was interrupted in only one case. This was due to an operating error and service was immediately restored.

The accompanying illustration of the damaged reactor gives some indication of the heat and of the copper vaporized. The insulation around the bus and around the disconnecting devices of the circuit breakers across the aisle from the damaged reactor was badly scorched, evidencing the intense heat.

Despite the magnitude of the trouble and the fact that there were two short circuits, the resulting damage was confined to one room. The reactor at which the trouble originated with its immediate connections and the feeder reactor next to it constituted the principal material loss. Two bus supports immediately in front of the reactor were slightly chipped and were replaced. The insulation on the connecting busbars was found to be charred only on the outside layer and this was scraped off and one layer of varnish cambric tape wrapped on. The insulating box around the selector oil circuit breaker contacts was replaced primarily for reasons of appearance. A little scraping and varnishing on the insulating housing on the next circuit breaker restored it to satisfactory appearance with insulating qualities unimpaired. Other insulators in this one room were merely wiped off to restore them to service.

The trouble occurred at approximately 2 o'clock. One of the group buses in this room was restored to service at 6 o'clock and the other about midnight.

The reactor compartment had only a partly inclosing door at the time of this trouble. Construction work was already in progress in other parts of the switch house on completely inclosing the front of the reactor compartment, and if such inclosure had been completed on this reactor, the damage would very probably have been still further localized.

It is a source of gratification to the designers that a major trouble in such a vital part of the station resulted in so little damage.

A recent trouble minor in its consequences has demonstrated the successful operation of the differential protection on a section of the synchronizing bus. On

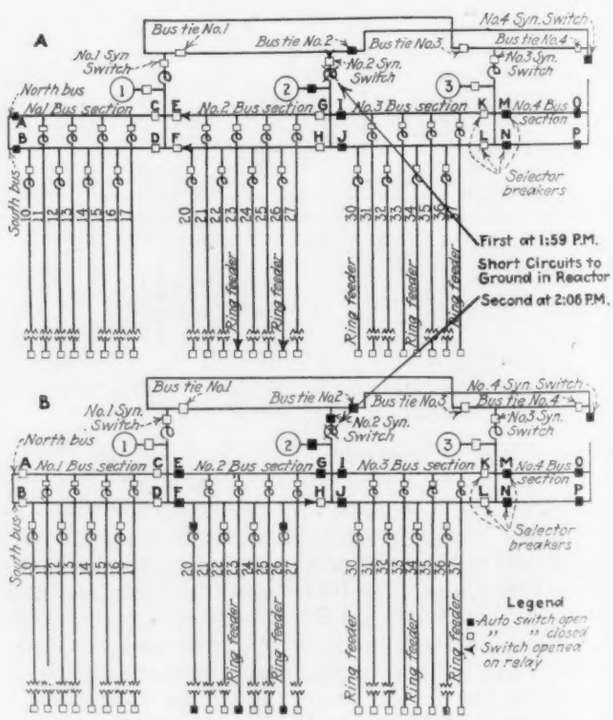


FIG. 4—SWITCH POSITIONS AT TIMES OF SHORT CIRCUIT INDICATED ON SINGLE LINE STATION DIAGRAMS

(A) At time of first ground. (B) At time of second ground

Feb. 7, 1926, a pothead on the cable connecting a potential transformer to the bus broke down. Differential relays promptly tripped the three breakers, killing the section of the synchronizing bus in trouble, with no interruption of service from the station. Damage was entirely confined to the pothead.

Hundred-Million-Kilowatt-Hour Utilities

United States Has 110 Such Systems—Energy Produced by These Represents 81 per Cent of Country's Total Generation—Niagara Falls Power Company Leads in Output During 1925

A SURVEY of the central-station industry in the United States and Canada recently completed by the ELECTRICAL WORLD brings out a large amount of valuable and very interesting information. A detailed statement of the results of this survey is presented in compilations of data which compose a supplement to this issue. It appears that during 1925 there were 110 electric light and power companies in the United States having an output of more than one hundred million kilowatt-hours. This compares with 106 in 1924, an increase of four companies. However, during 1925 several companies were merged so that the actual number of companies added to this tabulation during 1925 was several more than four.

Of the 110 companies, fourteen reported an output of more than a billion kilowatt-hours during 1925, the West Penn system and the Southeastern Power & Light Company system being added during the year. Seven companies operating in Canada also reported for 1925 an output of more than one hundred million kilowatt-hours.

The total output of the 110 companies operating in the United States was 56,079,006,233 kw.-hr. during 1925, with two companies not reporting. This figure compares with 48,725,178,113 kw.-hr. reported for 1924. These companies during 1925 generated a total of 49,076,033,707 kw.-hr., or approximately 81 per cent of the nation's energy generated, and also purchased 7,002,976,966 kw.-hr.

The details of these company operations are set forth in the supplement tabulations. The Niagara Falls Power Company again led the country, reporting a total output of 3,161,130,010 kw.-hr., all of which was generated in its own plants. The Commonwealth Edison Company of Chicago was a very close second with 3,091,424,000 kw.-hr., of which about 97 per cent was generated in its own plants. The Edison-United companies of New York were third. The Hydro-Electric Power Commission of Ontario, however, reported the largest output of all the systems in the world with 3,298,347,874 kw.-hr.

TABLE I—ENERGY DISTRIBUTION OF COMPANIES REPORTING AN OUTPUT OF OVER 100,000,000 KW.-HR. DURING 1925

Section	Energy Distribution to Light and Power Customers (Per Cent), 1925			Energy Sold to Electric Railways	Total Number of Customers (All Classes)
	Domestic Customers	Commercial Customers	Power Customers (Not Including Railways)		
United States	10.0	12.7	77.3	4,679,192,384	10,814,912
New England	8.6	8.1	83.3	116,185,544	628,890
Middle Atlantic	8.7	13.9	77.4	1,606,396,004	3,481,455
South Atlantic	7.2	11.8	81.0	309,387,439	513,708
East North Central	12.6	12.4	75.0	1,504,208,339	2,738,690
West North Central	12.0	20.4	67.6	72,336,408	1,159,296
East South Central	6.5	11.7	81.8	110,133,080	331,418
West South Central	12.3	18.4	69.3	71,576,462	274,304
Mountain	7.1	6.8	86.1	186,000,017	280,780
Pacific	9.5	10.5	80.0	702,969,091	1,406,371

The highest peak load was reported by the Commonwealth Edison Company with 809,000 kw. (instantaneous), followed by the Edison-United companies with 656,312 kw. (instantaneous).

The accompanying tables summarize the detailed data contained in the supplement. These 110 companies reported a total of 796 generating plants (24 companies not reporting) and a generator rating of 19,113,337 kva. (three companies not reporting). These supercompanies represent, therefore, approximately 73 per cent of the total generator rating of the companies of the country, and their plants generated approximately 81 per cent of the energy generated by the central stations of the country during 1925. Estimates of total generator ratings and energy generated were published in the issue of Jan. 2, 1926.

TABLE II—COMPARATIVE OPERATING CONDITIONS

Plant Factors		Load Factors		Line Losses	
Transmission	Metropolitan	Transmission	Metropolitan	Transmission	Metropolitan
284.4	108.9	83.5	58.0	21.8	22.8
246.8	101.6	75.6	54.5	21.6	22.5
120.3	101.4	62.0	54.0	21.0	20.7
115.1	87.7	57.9	53.7	20.1	18.4
103.4	84.4	57.3	52.8	19.3	18.1
94.8	83.8	57.0	52.8	17.8	17.3
90.0	80.2	56.1	51.0	16.8	16.6
86.5	80.2	53.0	50.8	16.1	16.6
82.5	79.7	52.9	48.1	15.9	15.9
78.6	77.1	52.4	46.9	15.2	15.3
78.1	76.9	52.2	45.7	15.1	13.9
73.4	76.2	51.7	45.6	14.9	12.7
72.9	69.1	50.2	45.0	14.4	12.3
69.6	63.3	48.1	44.5	14.0	11.4
68.6	62.0	48.1	44.4	13.8	11.4
64.7	59.6	46.0	44.2	13.8	11.1
63.4	58.4	44.8	44.0	12.6	11.1
60.7	52.9	44.1	40.2	11.4	10.1
47.7	46.0	39.8	40.0	10.2	9.6
40.0	45.1	34.4	36.6	9.6	6.8
Average				16.4	13.8

The distribution of this energy among the various types of customers is indicated in the accompanying Table I. In the country as a whole 10.0 per cent of the energy distributed to light and power customers exclusive of electric railways was sold for residential lighting and power, 12.7 per cent for commercial lighting and power and 77.3 per cent for power purposes. The proportionate distribution to lighting customers, 22.7 per cent, is materially below the figure of 33 per cent for the central-station industry as a whole. These large operating companies have a much higher proportionate power load than the smaller companies. A total of 4,679,192,384 kw.-hr. was sold to electric railways.

A most interesting set of data is that giving the average load factor of these companies in 1923 and 1925 (supplement tables). Some companies reported a considerable increase in load factor during the two-year period, but the indications are that in the industry as a whole only slight progress has been made in increas-

TABLE III—GENERATOR RATING AND OUTPUT OF COMPANIES REPORTING AN OUTPUT OF OVE

(Summary of Detail Tabulation Issued as Supplement to This Iss

Section	Number of Companies or Systems Reporting Over 100,000,000 Kw.-Hr.		Generating Plants and Generator Rating					
			Total		Fuel Burning Plants		Hydro-Electric Plants	
	1925	1924	Number	Rating, Kva.	Number	Rating, Kva.	Number	Rating, Kva.
United States	110	106	(f) 796	(c) 19,113,327	(g) 403	(b) 13,237,610	(g) 393	(a) 5,875,72
New England	10	9	(b) 51	1,175,147	(a) 14	889,092	(a) 37	286,055
Middle Atlantic	23	23	(b) 122	5,315,400	(a) 83	4,252,630	(a) 39	1,062,770
South Atlantic	12	12	(c) 80	(b) 1,560,164	(b) 26	(a) 762,559	(a) 54	(a) 797,605
East North Central	22	22	(c) 166	(c) 4,389,893	(a) 115	(a) 4,036,308	(b) 51	353,585
West North Central	10	9	(h) 99	(c) 1,869,441	(c) 48	1,357,106	(c) 51	512,335
East South Central	6	5	(b) 35	(b) 840,255	(a) 28	549,000	(a) 7	291,255
West South Central	6	6	36	461,535	36	461,535	0	0
Mountain	4	4	67	847,649	11	109,652	56	737,997
Pacific	17	16	(h) 140	2,653,853	(c) 42	819,728	(c) 98	1,834,125

(a) One company not reporting. (b) Two companies not reporting. (c) Three companies not reporting.
(d) Over one hour. (e) Over 30-minute period. (f) Over 5-minute period.

ing the load factor, some sections even reporting a decrease. From this one infers that the growth of the industry is continuing in the time-honored way—the addition of new customers to the lines because they demand service. It is the general idea that central-station selling efforts are aimed primarily at the improvement of load factor, to fill up the valleys in daily load curves and not to increase plant capacity. These tabulations do not show that selling effort, in spite of the fact that it is a constant phrase, is or has been in the past two years effective in increasing load factor. With a preponderant power business and industrial habits well fixed it is quite difficult to get any large load-factor changes.

From the detailed tables in the supplement a number of very interesting inferences may be drawn, inferences which very probably should not be taken as doing more than to indicate certain truths and not to express them quantitatively or exactly. The figures in Table II in the text were calculated from the data set forth in the supplement. Plant factors, load factors and line losses in per cent were calculated for twenty of the largest systems which could be classified as metropolitan in distinction from a second twenty classified as transmission systems. The figures are arranged in the tabulation in simple order of magnitude and not at all with any correspondence by company in horizontal arrangement. The intent is only to compare, by parallels, the ascending or descending values of the same factors in the two classifications.

The total output of the 40 systems concerned in this percentage tabulation was more than 29,500,000,000 kw.-hr., considerably more than half of the total output of the 110 companies listed in the detailed compilation. Inferences derived from these percentages should reflect actual conditions fairly accurately on this account and should, so far as generalizations ever can, have certain illustrative, and perhaps argumentative, value.

The first two columns in the table are plant factors, or the ratios of installed generating capacity to peak load. On first glance, the top five figures in the first column appear to indicate that something is being obtained for nothing or that overload ratings for generating machinery have been grossly underestimated. These figures mean only that certain companies are purchasing large quantities of energy at the time of the peak load. It is very probable that all of the plant factors above about 80 per cent represent the effect of purchased energy from adjacent systems. The large differences between the plant factors of metropolitan and transmission systems at the tops of the columns and the continual, though decreasing, differences in favor of the transmission systems all the way down, except at the very bottom, are significant. They demonstrate the advantages of interconnection in making use of the load diversities of large areas.

The two middle columns contain the load factors and exhibit almost as strikingly the same condition as does the paralleling of plant factors. There are the same differences in favor of the transmission systems. However, the differences have weightier significance here. Plant factors have not such justifiable claims to be true indications of conditions as have load factors because they do not always truly measure ability to serve. Neither do load factors, except by inference, but they do measure service that is being or has been given, and a statement of load factor presents more information than does one of plant factor. From these load-factor parallels may be taken positive and reliable evidence of the virtues of interconnection. When a system in one class can maintain a load factor of 25½ per cent higher than the best of the other class, there must be some inherent virtue in the first to account for the difference. That virtue is the ability to take advantage of load and time diversity.

There is no practical way to reduce the plant factors and load factors of the two classes of systems to single comparable values by totaling generating capacities and peak loads and outputs and taking averages. The composite or average plant factors and load factors determined in this way are all incorrect on account of the fact that the peak loads of all the systems concerned are not coincident in time, and therefore the true average load factors and plant factors cannot be determined.

The last two columns present actual line losses as they were reported, and like most factual accumulations they do not range themselves in smooth lines to point a moral. But some deductions can be drawn from facts. The metropolitan systems are in general older than the transmission systems, and it would appear that the higher line-loss factors for some metropolitan systems are due to the older constructions remaining in service and the large number of distribution transformers on the line. It would also seem reasonable to argue that the higher losses on some of the transmission systems are chargeable to long distances with duplicate and lightly loaded lines. The average figures at the bottoms of the columns are true indications because there is no time element in the relation of the

...00,000,000 KW.-HR. DURING 1925

...d Electrical World)

Total Output of Companies		Energy Generated by Companies, 1925	Energy Purchased by Companies, 1925	Highest Peak Load Reported (Instantaneous)	
1925	1924			1925 Kw.	1924 Kw.
56,079,006,233	48,725,178,113	49,076,033,707	7,002,976,966	809,000	717,000
2,981,624,711	2,446,945,206	2,527,747,211	453,827,500	203,199	167,929
17,479,953,287	15,082,881,048	14,856,828,785	2,623,124,502	656,312	615,283
3,925,556,427	3,728,797,714	3,208,623,039	717,192,388	291,000	(d) 287,000
12,115,185,113	10,576,578,148	10,806,386,938	1,308,798,175	809,000	717,000
4,494,525,551	3,602,578,569	4,255,451,445	239,074,106	258,626	(e) 181,172
2,666,583,047	1,790,662,616	2,360,812,019	305,771,028	291,000	(f) 189,050
1,096,806,106	1,165,706,173	891,983,837	204,822,269	57,830	53,400
2,421,252,468	2,305,514,013	2,325,890,045	95,362,423	172,600	159,150
8,897,519,523	8,025,514,626	7,842,310,388	1,055,004,575	395,900	343,701

(g) Twelve companies not reporting. (h) Six companies not reporting.
(i) Twenty-four companies not reporting.

total line losses to the total outputs, and they show that line losses are higher in transmission than in metropolitan systems. This is a reasonable result as the transmission systems have both distribution system and transmission line losses to supply, and these two effects more than offset the effect of the reliability of the service elements which go into the large metropolitan systems.

One of the First High-Voltage Lines in China

IN A recent issue of the *Siemens Zeitschrift* Herr K. Mosig gives a description of one of the first high-tension transmission lines in China. The power station, which was completed in 1924 by a company organized by the Siemens China Company and a number of Chinese capitalists, is located on the Suchan River near the Shanghai-Nanking Railway.

The initial installation consists of two 3,200-kw. Zoelly type steam turbo-generators operating at 3,000 r.p.m., but it is intended later to install two 10,000-kw. sets. The energy is stepped up from 6,600 volts to 33,000 volts for transmission to the towns of Shangschau and Wusie, a distance of, respectively, 6¼ and 20 miles. At the receiving substations the voltage is first stepped down to 2,300 volts and then to 380/220 volts.

Record Central-Station Activity

Greater Activity During Month of February—Output 12.2 per Cent More than Last Year—Final Figures for 1925 Operations

NEW records were hung up by the central station industry during February in both output and revenue. In past years the winter peak of the industry's activity were recorded during January, but industrial activities at the opening of the present year appear to have been such as to call for record energy consumption on into February. Such is the optimistic picture painted by the reports of central station operations received by the ELECTRICAL WORLD for the month of February, these reports covering more than 80 per cent of the industry.

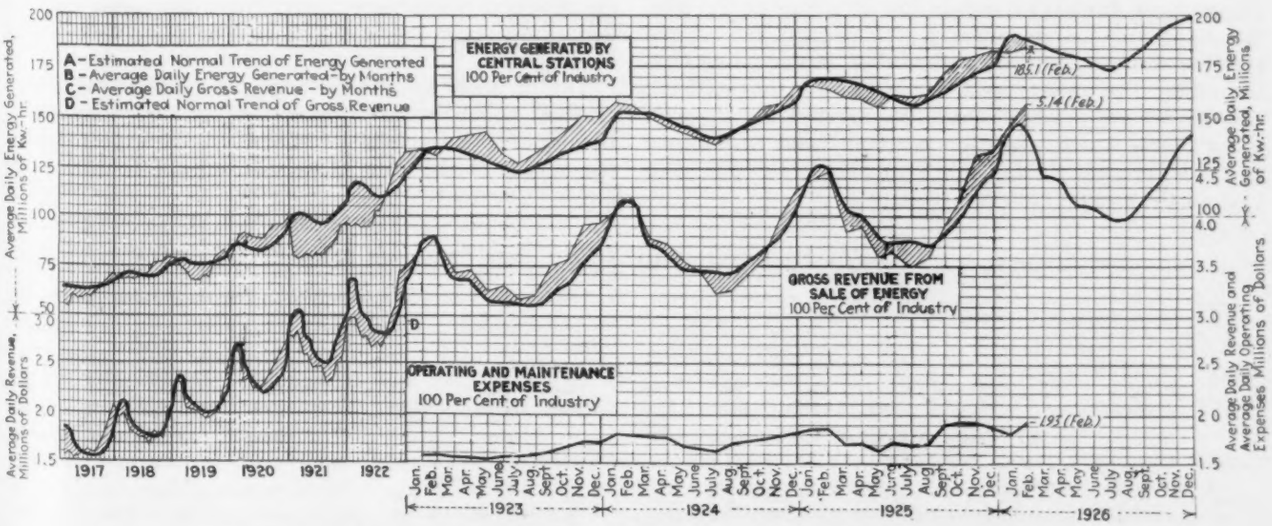
The total amount of energy generated by the electric light and power systems of the country totaled 5,181,401,000 kw.-hr. during February, a daily average of 185,100,000 kw.-hr., and a record figure for average daily output. This figure is an increase of 12.2 per cent over the output reported for February, 1925, but is 0.9 per cent below the estimated normal, this normal being based upon the operations of the past five years.

The gross revenue from the sale of energy during February was $143,800,000, an average daily revenue of $5,140,000 and another record figure for the industry. This revenue is 4.7 per cent above the estimated normal for the month.

Complete returns of central station operations during 1925 are now available. The energy generated by electric light and power systems during that year totaled 60,849,207,000 kw.-hr., a gain of 11.4 per cent over 1924; hydro plants generated 21,936,707,000 kw.-hr.

TABLE I—OPERATING RATIO OF CENTRAL-STATION COMPANIES

Month	Operating Ratio					
	Steam Plants		Hydro Plants		Combined Hydro and Steam Plants	
	1925	1924	1925	1924	1925	1924
December.....	45.6	45.8	26.0	27.4	41.8	44.0
	1926	1925	1926	1925	1926	1925
January.....	45.2	45.3	25.0	26.0	41.3	43.4
February.....	42.7	42.9	28.0	30.9	38.2	40.3


A - Estimated Normal Trend of Energy Generated
B - Average Daily Energy Generated - by Months
C - Average Daily Gross Revenue - by Months
D - Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
185.1 (Feb)
5.14 (Feb)
1.93 (Feb)
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses Millions of Dollars
1917 1918 1919 1920 1921 1922
1923 1924 1925 1926

BOTH CENTRAL STATION OUTPUT AND REVENUE REACHED NEW PEAKS IN FEBRUARY

TABLE II—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
December..	5,714,067	5,101,792	11.8	4,597,067	4,117,792	1,258,000	1,176,000	2,789,067	2,404,792	550,000	537,000	1,117,000	984,000	1,095,000	710,000
	1926	1925		1926	1925	1926	1925	1926	1925	1926	1925	1926	1925	1926	1925
January....	5,678,831	5,121,776	10.9	4,581,831	4,133,776	1,260,000	1,168,000	2,766,831	2,429,776	555,000	536,000	1,097,000	988,000	1,048,000	691,000
February...	5,181,401	4,621,235	12.2	4,180,401	3,729,235	1,128,000	1,044,000	2,551,401	2,201,235	501,000	484,000	1,001,000	892,000	1,009,000	745,500

* Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
December	$145,300	$128,200	13.4	$95,200	$92,000	$36,400	$24,900	$4,800	$4,770	$9,300	$6,530	$59,100	$55,600
	1926	1925		1926	1925	1926	1925	1926	1925	1926	1925	1926	1925
January..	153,300	137,200	11.8	99,600	91,600	39,020	33,670	5,050	5,210	9,630	6,720	56,400	53,900
February.	143,800	125,000	15.0	92,500	81,700	36,500	29,600	5,000	4,400	9,800	9,300	54,100	48,000

† Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

during the year and steam plants generated 38,912,500,000 kw.-hr.; the estimated amount of energy consumed for lighting purposes was 13,511,000,000 kw.-hr., a gain of 4.7 per cent over 1924; the estimated amount of energy sold to electric railways totaled 6,380,000,000 kw.-hr., a loss of 0.3 per cent; the estimated energy consumed for power purposes totaled 29,200,207,000 kw.-hr., a gain of 18.3 per cent; the estimated energy lost in transmission and used in intracompany business totaled 11,761,000,000 kw.-hr., a gain of 11.8 per cent. The gross revenue for the year totaled $1,483,676,000, a gain of 9.5 per cent, and the operating and maintenance expenses totaled $695,230,000, a gain of 12.2 per cent. The power plants of the industry consumed a total of 35,081,657 short tons of coal, 9,751,398 barrels of fuel oil and 45,470,715,000 cubic feet of natural gas.

While the above figures would indicate that 1925 witnessed a substantial growth in the activities of the electric light and power industry, the present indications are that the industry will record even larger gains during 1926. The present year opened with manufacturing activity several per cent above the average for the past three years, which condition has continued to improve up to the present time. This year should run ahead of 1925 in the annual gain recorded.

New Hydro-Electric Plant Completed in Sicily

IN A recent issue of *Energia Elettrica* Ing. Luigi Mangiagalli describes the hydro-electric plant which has lately been completed in Sicily to utilize the water power of the River Belice.

About 7½ miles from Palermo, at a height above sea level of nearly 2,000 ft., a dam 128 ft. high and 850 ft. in length has been constructed to form an artificial lake with a storage capacity of 16,720,000 gal. From the lake the water is led along an 8½-mile canal to an 11,000,000-gal. storage reservoir. From this the water is conveyed to the generating station by means of a penstock 265 ft. in length and ranging in diameter from 4¼ to 2¾ ft. The water reaches the power station under a head of 1,550 ft. at the rate of 660 gal. per second and at a speed of 17 ft. per second. The plant installation comprises four Riva-Monneret turbo-generators each one of which will develop 3,500 hp. at 750 r.p.m.

The turbines are direct-connected to 10,500-volt generators which were constructed by the Compagnie Generale di Electricitá of Milan. It is expected that the output of this new plant will amount to 25,000,000 kw.-hr. per year.

TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES *
(100 per Cent of the Industry)

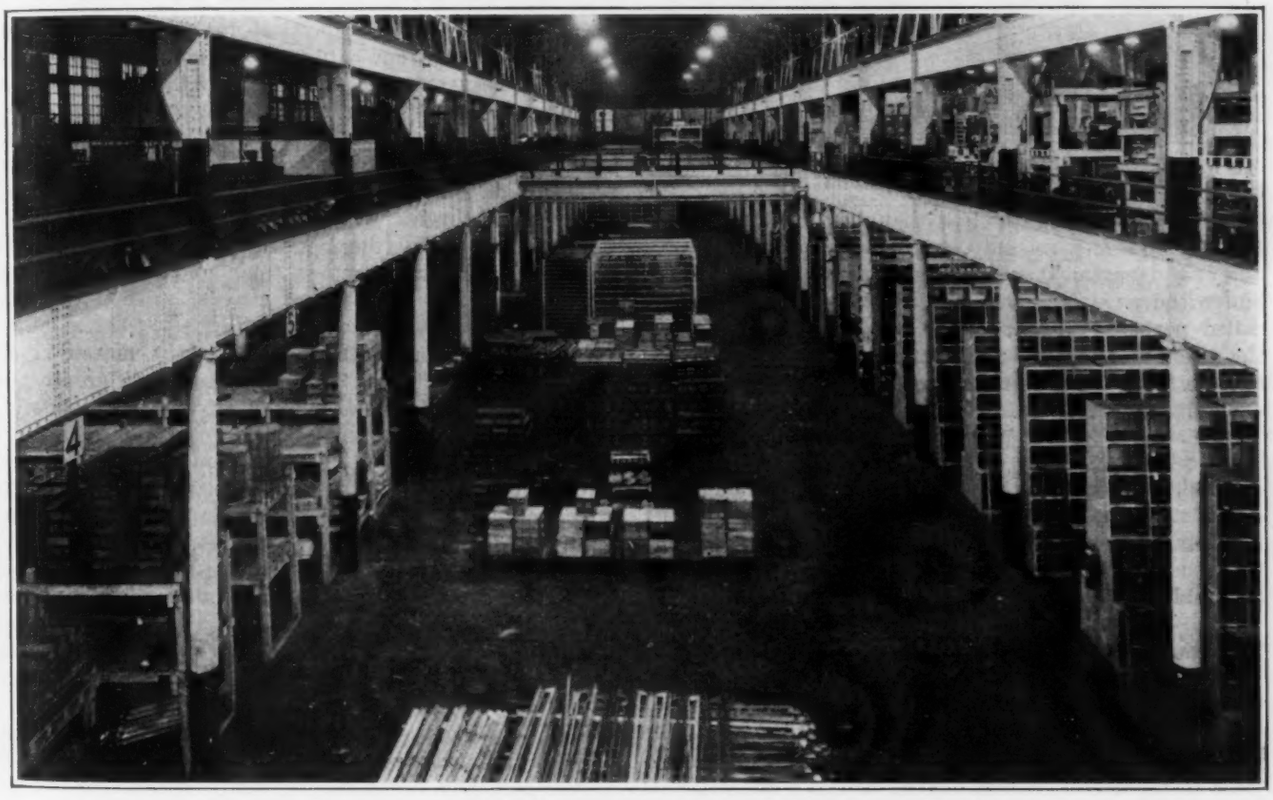
Month	Energy Generated						Fuel Consumption								
	Hydro Plants			Fuel Power Plants			Coal			Oil			Gas		
	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Increase	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Increase	1925 Short Tons	1924 Short Tons	Per Cent Increase	1925 Barrels	1924 Barrels	Per Cent Increase	1925 Thousands of Cubic Feet	1924 Thousands of Cubic Feet	Per Cent Increase
December..	1,946,949	1,724,970	12.8	3,767,118	3,376,822	11.6	3,350,689	3,173,141	5.5	761,140	1,328,668	—42.7	3,671,437	2,940,598	24.8
	1926	1925		1926	1925		1926	1925		1926	1925		1926	1925	
January....	1,929,324	1,676,536	15.2	3,749,507	3,445,240	8.8	3,280,535	3,230,153	1.5	960,630	1,329,855	—27.8	3,661,363	2,898,225	26.4
February...	1,870,592	1,725,877	8.4	3,310,809	2,895,358	14.2	2,933,275	2,741,313	7.0	655,900	959,595	—31.7	3,400,081	2,457,463	38.4

* As collected by United States Geological Survey. The data are for the electric light and power industry only.

Control of Material and Supplies

By Means of Monthly Inventories a Large Utility Stores Department Maintains Adequate Stocks to Meet Emergency Requirements—Details of System Developed in Pittsburgh

By C. A. HARRIS
Chief of Stores Duquesne Light Company, Pittsburgh, Pa.



MAIN BAY OF MANCHESTER CENTRAL STORE SHOWS ACCESSIBILITY OF STOCKS

A NUMBER of years ago a group of this company's foremen were asked to suggest a motto for the stores department. One of the men thought that judging by past performances we should adopt the words, "Ain't Got It"—not a very good slogan for a department which is primarily a service department. Although it is essential to reduce to the minimum the number of material refusals, they cannot be entirely eliminated.

Theoretically the demands for materials should be met irrespective of kind and quantity. In practice this is in a measure impossible because of a certain limit that must be set to investment in unapplied materials which is based on turnover of materials for maintenance, seasonal requirements and plans for construction. A particularly low inventory is no more of a criterion of an efficient stores department than a very high one, as either may be right or wrong, depending on circumstances.

In a manufacturing business the demand can be stimulated and production arranged accordingly. In our business this demand both for maintenance and for construction is spasmodic, seasonal and uncertain and cannot be regulated, but the flow of supply can be gaged in so far as both service and investment are concerned. This flow of supply is controlled mainly through the medium of inventories, supplemented by simplified methods in purchasing, handling and accounting of materials, also study of turnover, check on obsolescence and salvage.

STOCK CONTROL

Our entire set-up of stock control is based on monthly inventories on a quantitative basis and we use the stock book method of control in vogue now with most of the steam railroads and many of the larger utilities, the cardinal feature of which is an actual stock counting once a month.

This is not done for accounting purposes, but to see how much material there is actually on hand, and that, plus the materials due on open orders from vendors or our own shops and the amount that was received during the month, shows the actual consumption, which is the basis of replenishment. For fiscal purposes we take an annual inventory under the supervision and in conjunction with the accounting department. For the last year the net discrepancy of materials and supplies inventory was less than $1,000, the total value of the

SUBSTATION MATERIALS AND SUPPLIES

inventory being slightly less than two million dollars. If, for stock control only, we were to set up within our own department a ledger system where the receipt and withdrawal of each item are posted—that is, a so-called perpetual inventory—it would cost many times the possible inventory discrepancy, yet not give the assurance that the materials are actually on hand, as it would mean merely a theoretical book balance.

REPLENISHING AND STOCK TURNOVER

The investment in materials and supplies in the stores department can be gaged by computation on average monthly consumption basis. Materials for construction work such as transformers, transmission cable, etc., or seasonal requirements such as lightning arresters for power circuits, etc., are being bought according to the season and scope of the work. Market as well as manufacturing conditions are taken into consideration.

Under normal conditions a two months' stock which is turned over six times a year is desirable and should be the goal according to which the replenishing of materials is regulated. When buying in large quantities it might be more advantageous to place orders for more than two months' requirements, with the prerogative, however, of protracting the deliveries. Certain materials for maintenance known as emergency stock, such as spare transformers, spare armatures, parts for substations which should be carried as a safeguard to service, must be replaced on instant notice. The turnover of these is almost nil. However, since they represent a certain value in the inventory as emergency material, their aggregate value has a bearing on the total turnover per year, as well as construction material or that for seasonal requirements; therefore when the total inventory is considered the net turnover of all materials is always less than six times a year.

Anyone who has had the task of reconciling actual amounts found to be on hand with theoretical book balances of inventories knows what a hopeless task it is unless the inventory is taken in the shortest possible time with the greatest possible accuracy.

The materials and supplies of the Duquesne Light Company are stored at the Manchester central store, which also serves as a central store of the other affiliated corporations such as the Pittsburgh Railways Company, Allegheny Steam Heating Company, etc.

On Nov. 1, 1925, a physical inventory was taken there in nine and one-half working hours or 470 man-hours. The inventory comprised more than 25,000 items ranging from cotter keys to 20,000-kva. tranformers. The total value was slightly less than two million dollars. An inventory is of little value unless it can be taken as promptly as this, because we cannot cease to function and suspend service while it is in progress.

Several rules must be followed to achieve a quick and accurate inventory, whether taken monthly or once a year. Material such as chain, nails, washers, broken coils or reels of wire, etc., are estimated at the monthly stock counting but actually weighed or measured at the annual inventory. That is the only difference between our monthly and annual inventories. Briefly, the lineup for monthly inventories is as follows:

During the first five days of the month the fourteen stockmen in charge of their respective sections devote four and a half hours daily to counting and noting quantities found in the stock books. This book contains 31 pages, eight items to a page listing material as to kind and size. One stockman calls off the location reference, class number and description, the other the quantity. During annual inventory the number of teams is increased to 25, twelve of the men being stores accountants clerks.

Items tallied are marked with a small dot of paint, using a different color each year, so that when the job is finished, any items inadvertently overlooked can be spotted. This also serves to show if any items have been in stock for a period of years. Some other short cuts are used, but the cardinal principle is that with proper layout, orderliness and elimination of cumbersome methods an inventory can be taken quickly and accurately. The only answer is good housekeeping.

Discrepancies are looked into by stores accountants while the thing is fresh in everyone's mind. This demonstrates the great value of a quick inventory.

To enable us to count quickly and accurately we established the unit piling and packaging system. The

GENERAL STORES DEPARTMENT

_____ CO.

RECORD OF STOCK MATERIALS AND SUPPLIES

STOCK BOOK No. _____ Page _____ Section _____ STORE _____

NAME AND DESCRIPTION	UNIT	CLASS NUMBER	PURPOSE	GENERAL INFORMATION	Case Reference and Bin Number	Average Monthly Consumption Previous Years	1925-1926	JANUARY		FEBRUARY		MARCH	
						8th	1925	Due		Due		Due	
						7th							
						6th		On Hand		On Hand		On Hand	
						5th							
						4th	1926	Due		Due		Due	
						3rd							
						2nd		On Hand		On Hand		On Hand	
						1st							
						9th		Due		Due		Due	

STOCK BOOK SHEET USED IN MAKING MONTHLY INVENTORY AS A MEANS OF STOCK CONTROL

materials are placed in bins equipped with screen backs for maximum visibility, or if it is bulky, it is put on lift truck platforms so that 95 per cent of the material is counted without handling.

All materials in the custody of the stores department are classified according to the accepted material classification of the N.E.L.A. and A.E.R.A., which was modeled after the methods originated and worked out by these companies. These follow as closely as possible the classification of accounts by groups approved by the Interstate Commerce Commission.

We depend on our auditors to tell us the value of the materials on hand each month by classes and groups for all of our companies, and this information is of great help to us to determine the percentage of turnover in values. It is impossible by means of records that show on a quantity basis only the thousands of items and materials on hand to get the proper perspective of the movement of the groups of materials.

Monthly statements of money control according to material classification furnished by auditors are of invaluable assistance to us to determine our line of attack if the turnover is not within our expectations or aims; in other words, when we make an attempt to reduce our stock, we take our cue from the auditors' money statement.

In the utility business the art progresses so rapidly that through no fault of the designing engineers or master mechanics there is the constant problem of obsolescence, and it is the duty of a stores department to point out to the operating men those items which have not moved for some time and which have become obsolete through change of design or scope of the work.

The stores department must also arrange with manufacturers so that some of this obsolete material may be returned for credit or redesigning, or if all channels fail, the only thing left is to scrap it and sell it as salvage. Through the medium of maintenance committee and materials committee meetings this department is constantly in touch with plans involving changes of design or equipment, and we try so to regulate the flow of supplies that they will result in the least amount of obsolescence.

One of the important sources of revenue comprises the sale of salvage. Last year our two major companies disposed of upward of $300,000 in salvage or scrap, not considering the return of empty containers such as reels and drums, etc. This disposal of scrap is in itself a small business and to get the maximum value from the sale of ferrous and non-ferrous scrap we follow scrap classifications suited to market requirements.

On our properties the cost of disbursing $1,000 worth of materials is slightly in excess of $40. This includes storeroom labor, salaries of clerks, rent, taxes, insurance, heat, light, power and the expenses of that portion of the accounting department handling the books in connection with materials and supplies.

The factors for efficient storekeeping are originated within the stores department, but unless the users of the material lend their whole-hearted co-operation they are absolutely useless. The stores department, of all operating departments of a utility, is not self-sustaining, as it is the servant of the other departments and although in most cases it can foretell consumption based on past performances, it depends very much on being kept in touch with conditions by the departments it endeavors to serve. The fact that some stores departments do not give as prompt and good service as possible is due in a large measure to the users of materials who either forget or have never been impressed with the importance of estimating in advance with a fair degree of accuracy what their future requirements will be. Where estimates are obtained they are frequently furnished under protest or without full appreciation of their significance, with the result that they are hastily prepared and woefully inaccurate.

It is manifest that inventories should be kept as low as possible, not only because the investment is inactive but because of the high cost of operation; nevertheless delays in service to customers or delays in repairing equipment must be guarded against before any thought is given to reduction of stock balances.

Maintenance Experience on Automatic Substations

Experience of Kansas City Company with 87,300 Kva. of Automatically Controlled Equipment Shows That Adequate Maintenance Is the Only Guarantee of Good Service

THREE years of experience with one of the country's largest automatic substation systems has convinced the management of the Kansas City Power & Light Company that, given proper maintenance, automatic substations make for better service and lower operating cost than manually operated substations. This does not mean that automatic substations have fewer potential sources of trouble. As a matter of fact, they probably have more. But a thorough system of inspection will very often locate faults before they have time to cause trouble.

In the Kansas City company all inspection and maintenance of automatic substations (and also of the manually operated substations) are under the direction of the system operator. Specific supervision of large apparatus is directed by one foreman, and supervision of relays is handled by another foreman, who is a specialist on relays. Every piece of apparatus is listed on maintenance and inspection report forms. Periodical inspection is made of every piece of apparatus.

The maintenance and inspection of the three general classes of automatic substations in operation on this system are as follows:

1. Five direct-current, three-wire automatic substations; 18,600 kva. total.

(a) Meters are read and general inspection made of premises three times a week.

(b) From 8 a.m. to 12 midnight one man goes from station to station. He checks pressure point voltage load on direct-current circuits, ventilation, bearings, etc. He visits each station about every two hours, and is always in touch with the load dispatcher. A second man is also available for emergency service.

(c) All alternating-current and direct-current breakers, contactors, controllers, meters, rotaries, blowers, etc., are inspected and cleaned weekly. Rotary converters are cleaned every other night.

(d) Voltage-regulating relays, that hold pressure point voltage constant, are checked weekly. Alternating-current and direct-current overload relays are checked every six months. All other relays are checked and all relay contacts are cleaned every two weeks.

2. Four complete alternating-current automatic substations; 66,000 kva. total.

(a) Meters are read and general inspection of premises is made three times a week.

(b) Oil circuit breakers that operate daily are completely overhauled every three months, and breakers that operate

AUTOMATIC SUBSTATION EQUIPMENT FAILURE REPORT COVERING FIVE DIRECT-CURRENT AND FOUR ALTERNATING-CURRENT STATIONS, SEPTEMBER AND OCTOBER, 1925, KANSAS CITY POWER & LIGHT COMPANY, KANSAS CITY, MO.

Date Sept.	Sub-Station	Device	Description of Trouble	Primary Cause of Trouble	How Remedied	Effect on System
2	W	Temperature relay	Temperature relay on direct-current end of rotary opened and shut down machine	Hot weather caused bearing to overheat	Nothing done	Feeding point of No. 2 rotary slightly low for a few minutes
3	U	No. 19A breaker	Direct-current resistor breaker failed to close automatically	Loose connection on terminal of closing coil	Repaired loose connection	None
3	T	Balanced voltage relay	Rotary failed to get on line on first start	Relay failed to make the A-contact	Readjusted relay	None
3	T	Temperature relay	Bearing temperature relay on alternating-current end of rotary opened and shut down machine	Hot weather	Nothing done	None
3	W	Temperature relay	Bearing temperature relay on alternating-current end of rotary opened and shut down machine	Hot weather	Nothing done	Feeding point of No. 2 rotary slightly low for short time
	R	Controller	R-1333 feeder and No. 2 bank failed to cut out after station load had decreased	No. 25 finger on controller failed to make contact	Adjusted finger on controller	None
4	T	Temperature relay	Bearing temperature relay on alternating-current end of rotary opened and shut down machine	Hot weather	Nothing done	None
5	T	Direct-current breaker	Main direct-current breaker failed to close first time	Breaker latch had been shimmed too high	Removed some of shims	None
6	V	Direct-current brushes	Sparking on commutator	Feather mica	Under cut mica	None
8	C	Voltage-regulating relay	Voltage carried 4 volts too high	Relay out of adjustment	Readjusted	No. 1 rotary feeding point slightly high
9	W	Contactor	Hot contacts	Contacts blistered	Installed new contact fingers	None
10	E	Oil circuit breaker on E-411-A circuit	Failed to close during a test	Lost motion in closing mechanism	Readjusted closing mechanism	None
10	T	Alternating-current relay	Contacts sparking	Worn toggle	Readjusted toggle	None
11	A	Automatic signal	When circuit opened, signals on dispatcher's desk failed to show the operation	Broken connection in bus ring on distributor at substation	Repaired broken connections	None
11	W	Main alternating-current control contactor	Failed to open and prevented machine shutting down	Wires to interlock on main direct-current breaker were short circuited so that when direct-current breaker opened it did not open circuit on coil of alternating-current contactor	Cleared up short circuit on interlock	Voltage in Sub. "W" district slightly low for short time
1	A	Relay on starting O.C.B.	Tie breaker failed to open when A-1312 feeder and No. 2 bank cut in	"A" contact on relay not making good contact	Readjusted the A contact	None
13	W	Main line direct-current breaker	Failed to open when rotary shut down	Tripping toggle had worn	Readjusted tripping toggle	None
4	T	Direct-current breakers	Breakers pumping and carbon contact on one breaker came off	No trouble on breakers	Installed new carbon contact	None
16	A	Voltmeter and ammeter jack on A-426 circuit	Unable to get readings on instruments	Instrument jack burned up	Installed new instrument jack	None
16	T	Automatic louvers	Operating coil burned out	Coil overheated	Installed new type of coil	None
16	T	Time delay stopping relay	Failed to shut down rotary after load had dropped off	Collar on push rod caught on toggle	Installed new toggle	None
17	R	Automatic signal	Reset at dispatcher's desk failed to reset signal change light on Sub. "R" board	Polarizing relay on A-phase of R-456 circuit was making poor contact	Cleaned and adjusted contacts on polarizing relay	None
18	T	Main O.C.B.	Closing coil burned out	Anchor bolts on auxiliary contactor pulled out of panel, allowing contacts of contactor to close, energizing one coil of O.C.B.	Installed new coil on breaker and put in anchor bolts that go clear through panel	None
21	U	Main line direct-current breaker	Trip coil burned out	Interlocks on breaker failed to open, allowing trip coil to remain energized	Repaired coil	None
21	C	Master starting relay	No. 1 rotary failed to come on when voltage was down to 220 volts	No. 1 relay out of calibration	Recalibrated relay	None
21	A	L. O. B. relay	A-1312 feeder and No. 2 bank failed to cut in	L. O. B. relay failed to make good contact	Cleaned contactor on L. O. B. relay	None
23	U	Overload relay	Relay opened and shut down rotary	Possibly current at starting was sufficient to slightly open contacts and vibration caused relay to operate fifteen minutes after machine was on line	Test and inspection failed to show any trouble	None
27	A	O.C.B. on A-421 circuit	Smoked and threw oil when switch was opened by hand, also arcing tips on switch were burned	Cable on A-421 circuit punctured at pothead pole	Repaired A-421 circuit cable	None
30	W	Running O. C. B. motor-operated	Failed to close on first attempt	Possibly breaker failed to latch	Nothing done	None
30 Oct.	C	Rheostat	"Raise" and "lower" auxiliary relays both closed, causing motor to heat	Raising relay remained closed	Inspection showed no trouble	None
3	R	Motor-generator	Two risers on generator came unsoldered	Apparently leads were improperly soldered	Overhauled armature	None
3	V	Power factor relay	Coil burned up when machine started	Relay improperly connected after testing	Installed new coil	None
3	R	Automatic signal	Alarm at dispatcher's office operated with no switches operating at substation R	Possibly one polarizing relay was making poor contact	Trouble cleared itself	None
4	W	Voltage-regulating relay	Carried voltage low on machine	Relay out of calibration	Recalibrated relay	None
5	T	Master starting relay	Rotary failed to come on when bus voltage dropped to 221 volts	Relay out of calibration	Recalibrated relay	None
5	D	Automatic signal	False indication at dispatcher's desk	Probably one of release magnets failed to release	Cleared itself	None
7	A	O. C. B. on A-426 A circuit	Failed to stay closed	Air cushion out of adjustment, allowing switch to close too hard	Readjusted air cushion	None
11	A	Auxiliary relay	Tie breaker failed to open when A-1312 feeder and bank No. 2 cut in	Relay failed to make contact	Cleaned and readjusted contacts on relay	None
15	A	Auxiliary relay	A-1312 feeder and No. 2 transformer closed when overload came on, but No. 7 tie breaker failed to open.	Relay failed to make contact	Adjusted contacts	None
25	A	Regulator contact-making voltmeter	Regulator in full boost position	Contact-making voltmeter stuck	Cleaned contacts	Pressure high on A-408-C circuit
27		Auxiliary relays	Both closed at same time	No trouble on test. Might have been residual	Installed shading coils on plunger	None
27	W	Thermostat valve on air-recirculating system	Valve not working properly	Valve out of adjustment	Adjusted valve	None
28	T	Time delay relay	Failed to open contacts and shut down machine	Too much tension on toggle spring	Adjusted toggle	None
30	T	Controller	Machine failed to start	Poor contact on No. 27 finger	Adjusted contact	None
31	D	Signal system	Distributor noisy	Governor out of adjustment	Adjusted governor	None

infrequently are examined once a year. In case a breaker opens under heavy duty, it is inspected immediately.

(c) Breaker mechanisms are cleaned and inspected every two weeks.

(d) Relays are cleaned and inspected monthly. Overload relays are checked every six months.

(e) Reclosing breaker equipments are tested monthly.

(f) Induction regulator equipment is tested and inspected every two weeks.

(g) Bus compartments, disconnecting switches, etc., are inspected and cleaned every six months.

(h) Oil in transformers and circuit breakers is tested once a year.

3. Four outdoor transformer substations with reclosing oil circuit breakers; 2,700 kva. total.

(a) Premises inspected every two weeks.

(b) Relays inspected and cleaned every three months.

(c) Oil circuit breakers inspected and overhauled every six months. In case a breaker should open under heavy duty, it is inspected at once.

(d) Substations having induction regulators have the regulator equipment inspected every two weeks.

In addition to the automatic substations having a total installed capacity of 87,300 kva., the same crew of men performs maintenance duty in other substations and on isolated and special apparatus throughout the company.

There is a total of 27 men on the maintenance crew, divided as follows: Two apparatus foremen, one instrument and relay foreman; one air filter man (takes care of the air filters in the five direct-current substations), one battery man, one battery man helper, one general machinist, one electrical machinist, one regulator man, nine general maintenance men, five helpers, and four instrument and relay men. If the present automatically operated substations were manually operated they would require 29 additional operators and seventeen additional helpers, and four maintenance men would be released, making a total net increase of 42 men.

The right kind of maintenance and supervision can make automatic substations render superior service to any manual substation. The accompanying tabulation of maintenance reports for September and October, 1925, shows the general type of reports covering the automatic substations, direct and alternating.

A stock of repair parts for all devices in both direct-current and alternating-current substations is kept on hand, so that any device can be repaired or replaced in a short time. A complete description and illustration with factory designation of each piece of apparatus is part of the maintenance department record, as well as factory connection prints of all transformers.

The Electric Motor Truck

Characteristics and Advantages of Electric Vehicles—Their Effect Upon the Revenue of Central-Station Companies—Possibilities of Development in Proper Fields of Application

By D. M. PHILLIPS*

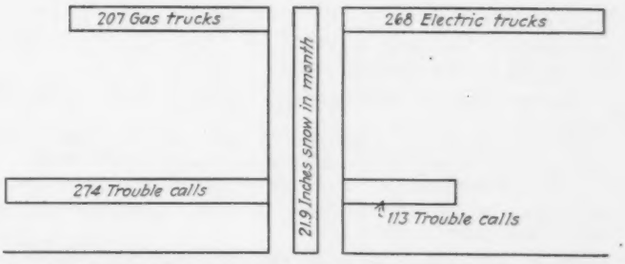
UNQUESTIONABLY the electric truck is superior to almost any form of transportation in the short haul or frequent stop service. Its motive power consists merely of one or more electric motors, supplied with current from a storage battery, and operated by a simple controller located at the driver's seat.

Gasoline trucks, on the other hand, derive power from an engine composed of several hundred moving parts, many of which are in constant sliding or rotating motion whenever the engine is running. In addition to such complexities, the gasoline truck has also to contend with an intricate system of transmissions and differentials for supplying the necessary force to the driving wheels. This necessarily involves a much higher repair rate for gasoline trucks and the figures in Tables I and II, compiled by the American Express Company in ten cities, substantiate this statement. It will be seen from these tables that the operating costs for the electric truck are considerably lower than for the gasoline truck.

LIFE COMPARISONS

The average life of a gasoline truck seldom exceeds five years, and most of them are ready to be scrapped after three or four years' service. Electric trucks, on the other hand, have a useful life that frequently exceeds fifteen or twenty years. Length of service of electric trucks operating in New York City are as follows:

2,899	over	7	years	221	over	14	years
2,448	"	8	"	156	"	15	"
2,044	"	9	"	132	"	16	"
1,580	"	10	"	116	"	17	"
1,285	"	11	"	74	"	18	"
980	"	12	"	33	"	19	"
395	"	13	"	25	"	20	"



COMPARATIVE RELIABILITY OF ELECTRIC AND GASOLINE TRUCKS

Electric trucks practically never wear out. Only certain parts wear out where friction is the greatest, and the truck is so designed and constructed that the replacement of these parts is a small operation.

Reliability of the electric vehicle may be shown graphically and from figures obtained from the American Express Company this characteristic is illustrated in the accompanying chart. The number of trouble

*This article is an abstract of a thesis, "The Electric Truck and Its Effect Upon the Earnings of Central-Station Companies," prepared by Mr. Phillips as his senior research work at the University of Pennsylvania, 1925.

calls for gasoline trucks is compared with those for electrics.

During the year 1922 there were, according to records kept by the American Railway Express Company, twenty-seven separate and distinct mechanical features that caused the gasoline truck to become inoperative on the road, and only eight mechanical features that caused like failure of electrics. The averages for the year show that each gasoline truck required help seven times, while the electric trucks required help only twice per truck per year.

Two of the causes for electrics becoming deficient in operation stand out above all other causes by reason of their more frequent occurrence. Broken driving chains caused 11 per cent of all trouble calls, but as this type of drive is not used in the more modern type of truck, this will become decreasingly important. Run-down batteries caused 19 per cent of trouble calls through drivers trying to stretch the radius of operations.

LOWER INSURANCE RATES

A general reduction in the insurance rates affecting electric trucks became effective Jan. 1, 1924, and the Manual of Jan. 14 shows that fire and theft policies on electrics cost from 40 to 45 per cent less than those on gasoline vehicles for the same amount of insurance. It is also interesting to note that the provisions are for a life of five years with the gas truck and ten years with an electric. The following clauses included in the Automobile Casualty Manual for 1924 are particularly favorable to the electric vehicle:

TABLE I—COMPARISON OF GARAGE REPAIR EXPENSE PER DAY OF SERVICE

City	Gasoline Truck	Electric Truck	City	Gasoline Truck	Electric Truck
No. 1	$1.69	$1.01	No. 7	$0.99	$1.32
No. 2	.94	.67	No. 8	.85	1.40
No. 3	1.81	1.37	No. 9	1.39	.84
No. 4	2.13	1.18	No. 10	1.78	1.70
No. 5	1.49	1.10			
No. 6	1.10	.96	Average	$1.41	$1.15

Electric Public Automobiles. Reduce above rates 25 per cent.

Electric Garages. Shall be 25 per cent less than those for gasoline or steam car sales agencies or repair shops.

Collision Premiums. Premiums for electric commercial cars shall be 25 per cent less than the corresponding premiums for gasoline cars.

From these data it may be seen that the owner of an electric vehicle has an advantage of more than 40 per cent in fire and theft insurance and at least 25 per cent in collision, public liability and property damage insurance. It has been claimed that it is a great disadvantage in that the batteries have to be recharged at frequent intervals. This is not necessarily the case if the truck comes back to "home port" at least once a day, when it may be handled in a number of ways. The most important and practicable are:

1. By having the batteries charged at the public garage where the truck is stored over night.
2. By arrangement with the local power company to charge the batteries at its own plant.
3. By installing equipment in the operator's own garage or loading platform.
4. By making a complete change of batteries.

The chief advantages of the electric truck over other forms of transportation in the short-haul, frequent-stop field may be recapitulated as follows:

1. Greatly reduces costs. It has already been brought out that repairs were less and likewise there was a smaller expense for electricity for propulsion than for gasoline. Statistics compiled by the Post Office Department show that where there is frequent stopping and starting the gasoline consumption is three to four times as great as on long hauls.
2. They are the fastest trucks obtainable on short-haul or frequent-stop routes. A stop on every block or so makes the electric much faster than the gas truck, because there is a steady torque and full power available immediately. There is also no necessity for changing gears either when stopping or starting. Another feature that increases the speed is that it maneuvers in less time in or out of crowded traffic. It turns around in less space and does it quicker.
3. The extreme simplicity of the electric makes it easier to operate than any other type of truck and it is also easier to repair and keep in operation.
4. The ruggedness and reliability of the electric compared with other types has already been brought out in the chart.
5. The average life of an electric truck is a great deal longer than other trucks. Insurance companies give a life of five years to a gas truck and ten for an electric. Actual conditions, however, would substantiate the statement that an average electric is good for at least twenty years under normal operation.
6. Cleanliness is one of the best features of the electric. There are no obnoxious gases to spoil foodstuffs or other materials being transported.
7. Quietness in operation is a most important feature. It is quite probable that with the present congestion of traffic, a problem of ever-increasing importance, delivery at night by means of electric trucks will continue to increase in importance.
8. There are no odors of any sort given off, no exhaust of poisonous fumes to pollute the air in the congested districts.
9. Garage space may be saved by storing it at the loading platform. It likewise requires the minimum amount of space, because it may be maneuvered in such a small area.
10. It uses power with the minimum amount of waste. There is none going to waste as in the case of gasoline trucks when the motor is idling. Likewise, a steady torque and an even application of tractive power results in added efficiency.
11. All of the speed consistent with prudence in city running and power economy may be obtained. Although the speed varies from ten to fifteen miles per hour, that, together with its facilities for quick stops and starts, makes it the fastest method for making deliveries.
12. Another good feature is that the employer can have absolute control over the speed at which the truck may be operated.
13. Tractive power is greatest in proportion to the horsepower used. This is caused by the steady torque of the electric, while the gasoline truck receives its power through intermittent jerks as the gases in each cylinder explode.
14. The hazards of fire and theft and possibilities of accidents are considerably less with the electric truck.
15. Operating and maintenance costs are a great deal less.

TABLE II—COMPARISON OF "FUEL" COSTS PER TRUCK PER DAY

City	Gasoline Trucks: Gasoline and Oil	Gasoline Trucks: Current	Electric Trucks: Battery Charges	Electric Trucks: Total
No. 1	$1.81	$0.65	$0.94	$1.59
No. 2	1.92	.42	.61	1.03
No. 3	2.02	.42	.19	.61
No. 4	1.73	.60	.19	.79
No. 5	1.31	.45	.83	1.28
No. 6	1.48	.48	.55	1.03
No. 7	1.56	.48	.12	.60
No. 8	1.05	.41	.68	1.09
No. 9	1.27	.66	.65	1.31
No. 10	1.96	.55	1.41	1.97
Average	$1.61	$0.513	$0.617	$1.13

It is necessary also to consider the horse as a factor in the transportation field, and here the superiority of the electric truck is even more obvious.

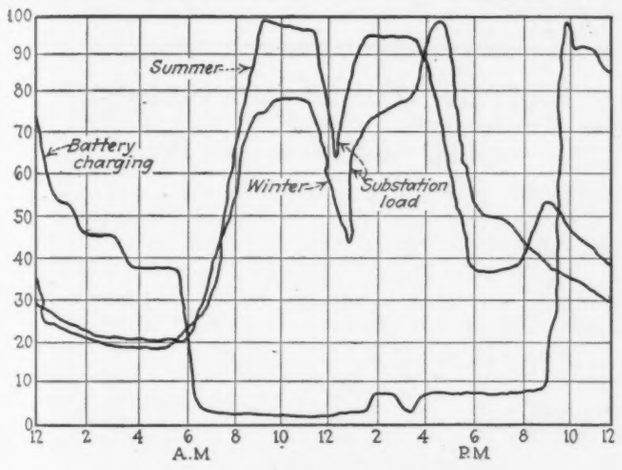
The cruising radius of the electric is twice as great as that of the horse and the speed from three to four times more. When the initial outlays are taken into consideration, it is shown that the complete costs are only a few cents more per day than for a team of

horses. It has at least twice the service capacity of horse trucks on account of the number of different loads that may be handled in a given period.

At the present time the American Railway Express Company is operating 1,800 electric trucks because of the advantages they have over other forms of transportation in the delivery field.

The electric truck is essentially a city delivery unit, and is especially economical on a house-to-house delivery system. It is not the best unit for most of the work the gas truck has taken from the railroads or created for itself. It is the most economical unit of transportation for all of the work still done by horses in cities and large towns. It is also more economical in most of the work which the gas truck has taken from the horse.

It has been estimated that from three-quarters to four-fifths of all urban goods transported should be done by electrics. When this is accomplished, electric trucks will save a sum running into hundreds of millions



DESIRABLE OFF-PEAK CHARACTERISTIC OF BATTERY-CHARGING LOAD

of dollars for their owners and the people whom they serve.

The fact that a battery-charging load means an increased revenue of $1,000,000 to the New York Edison Company alone and a proportionate amount to other utilities operating in Boston, Hartford, San Francisco, Newark, Philadelphia, New Orleans and Los Angeles shows the importance of this load to the central-station industry. It has been estimated that one truck will consume the same amount of electricity as twenty-five ordinary city homes. Likewise the consumption of one average electric truck is equivalent to the following: 125 flat irons, 310 washing machines, 760 heating pads, 170 grills, 225 percolators, 140 radiators and heaters, 225 toasters, 500 chafing dishes, 350 fans, 280 vacuum cleaners, 500 sewing machines.

A most important factor from the viewpoint of the central station lies in the fact that the greatest consumption of electricity takes place during the off-peak hours. By far the greater part of the battery charging takes place between 10 o'clock at night and 6 in the morning. The accompanying chart will illustrate the point nicely.

Central-station companies have taken a most important step in bringing a closer relationship between the manufacturers of trucks, consumers of electricity for this item, and themselves. This was brought about by the additions of electric trucks to their fleets. Companies that have adopted the electric truck to a large degree are listed as follows, with number of vehicles operated:

Company	Number of Trucks
Commonwealth Edison Company	265
New York Edison Company	124
Consolidated Gas Co., New York	61
General Electric Company, Schenectady	55
Philadelphia Electric Co.	47
Peoples Gas, Light & Coke Co., Chicago	35
United Electric Light & Power Co., New York	32
N. Y. & Queens Electric Light & Power Co.	29
Milwaukee Electric Railway & Light Co.	29
New Orleans Public Service Co.	28
Edison Electric Co., Boston	27
Brooklyn Edison Co.	25
Public Service Co., Chicago	22
Duquesne Light Co., Pittsburgh	21
Hartford Electric Light Co.	16
Virginia Railway & Power Co., Richmond	16
Toledo Edison Co.	15
Bureau of Power & Light, Los Angeles	12
Cambridge Electric Light Co.	12
Brooklyn Union Gas Co.	10
Potomac Electric Power Co., Washington	10

In that it is to the advantage of the central stations to increase the use of electrics, they should expend every effort toward that end. A number of companies have been conducting experiments and publishing the results, and others have been working along other lines. For instance, the San Joaquin Electric Company conducted extensive tests with gasoline and electric trucks. Four pairs of trucks were tested, each composed of an electric and a gasoline truck of about the same capacity and designated for about the same kind of service. The following comparison of cost of electricity with gasoline shows that "fuel cost" of electrics was approximately one-half that of the gasoline:

Truck Pairs	Capacity, Tons	Electricity per Mile	Gas per Mile
No. 1	0.75	1.73c.	2.20c.
No. 2	1	2.63c.	5.73c.
No. 3	2	3.27c.	9.91c.
No. 4	2 Spec. Designs	3.47c.	6.17c.
Average per ton-mile		2.07c.	4.16c

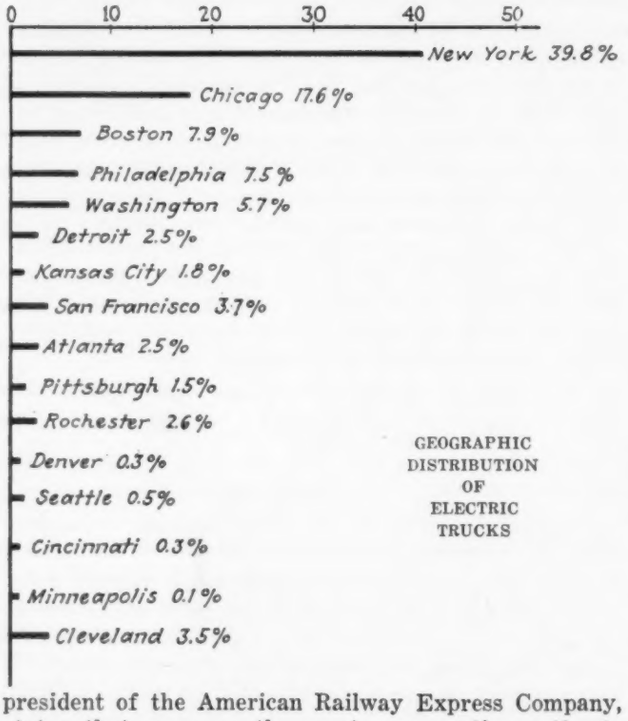
From the nature of the electric truck and the fields in which it has been found to be the most advantageous method of transportation, it is logical to find that the power companies that derive the greatest amount of revenue from this source are located in the larger cities of the country. The geographical distribution of electric trucks throughout the United States by districts is shown in the accompanying chart. This does not mean, however, that there are not many possibilities for the economical use of the electric vehicle in many smaller cities.

A census of electric vehicles taken in the United States in July, 1921, showed the following number in operation: 8,656 trucks and 8,050 industrial conveyances that are used to transport goods from one part of a factory to another, or those conveyances seen in most terminals for carrying mail, baggage, trunks or things of that sort. There were also 16,650 electric passenger cars. At the end of 1924 both units of the first group had increased enormously in proportion, while the passenger vehicle had decreased in actual numbers because of the inroads of the gasoline pleasure car, which is admittedly superior in that particular field. Figures taken during the latter period showed that the number of trucks had increased to 13,218 and the industrial conveyances to 11,765. These industrial trucks use on an average the same amount of energy as a street truck. The first group showed an increase of 65.4 per cent and the second 68.4 per cent.

Using 51.3 cents as average cost of electricity for one truck per day of operation, the above figures indicate that power companies are now receiving a revenue of $6,780.83 per day from this one source. It also means

a yearly revenue of almost two and a quarter million dollars to the central-station companies. This figure is small compared with the total value of energy consumed, but when it is considered that the greater percentage of this amount is drawn from central stations located in the large cities, it can readily be seen how their revenue is increased by this demand.

An intelligent estimation of the potential demand for electricity for propulsion of motor trucks may be made by comparing it with the decreased number of horses and the steady increase of electric trucks, the percentage for which is greater than for gasoline-driven vehicles. At the present time only 4 per cent of the city hauling is done by the electric truck. E. M. Cowie,



GEOGRAPHIC DISTRIBUTION OF ELECTRIC TRUCKS

president of the American Railway Express Company, states that even on the most conservative estimate possible at least 75 per cent to 85 per cent of all city deliveries should be handled by the electric.

The one market that is probably able to absorb more electric trucks than any other type is the creamery business. In the United States and Canada there are more than 30,000 creameries and milk dealers that use anywhere from two to 2,400 vehicles each. Estimates place the number of delivery trucks that could be used in this field at from 120,000 to 200,000. In Detroit a saving of $8,000 per month has been made by a large creamery which substituted electric delivery for the gasoline trucks and horse-drawn equipment previously used.

In many of the larger cities of the country horses are actually decreasing in numbers very rapidly. The high cost of feeding them and the impossibility of stabling them in congested districts have led to a gradual replacement in the cities. Figures compiled by the New York Health Department over the past seven years show the following number of horses in the city: in 1917, 103,036; in 1919, 75,740; in 1921, 65,126; in 1924, 50,053. An actual decrease of 57 per cent has taken place in the horse population. Electric trucks, on the other hand, have showed an increase of 139 per cent between 1913 and 1925. During the former year there were 1,958 electric trucks in operation, and in 1924 this number had increased to 4,675.

Authorities on the electric truck have agreed that 75 per cent to 85 per cent of all city hauls should be made with the electric truck. Using the truck registrations for 1924 as a basis, there would be 900,000 or more electric trucks on the streets, assuming that all shipments of goods were made in the most advantageous and economical manner. The potential market for electric trucks is surprising and when one considers that each truck will consume between 6,000 and 10,000 kw.-hr. annually, the possibilities of tremendous sales of energy for charging batteries becomes apparent.

The development in the electric truck field within the past few years has made it imperative that central stations in the cities regard them in a different light from that in which they have previously regarded them. All indications point to a steady increase in the number to be placed in use, and those power companies that aid in the development and sale of electric trucks need have no fear of failing to make a handsome profit from an off-peak load.

Letters from Our Readers

Group Versus Individual Drive

To the Editor of the ELECTRICAL WORLD:

I agree quite fully with the editorial in the Dec. 19 issue of the ELECTRICAL WORLD entitled "Is Group Driving on Its Last Legs?" To say that individual drive is always the thing is wrong. To say that group drive should always be employed is equally absurd. One might as well say that No. 2 copper is always the correct size to use for electrical conductors. Just as your editorial says, if one wishes to specify the type of drive best suited to a certain industry or department or shop, the conditions should be studied.

As suggested in the editorial, a more or less complete balance sheet of advantages and disadvantages should be drawn up with as definite an evaluation as possible of each. In many general cases the answer could be arrived at without going into a great deal of study. In other cases it might be desirable to analyze all of the factors—fixed charges, current cost and operating features—quite completely, particularly if the amount involved were large. I think the logic of the editorial is obvious.

FORD BATES,
New-Business Department.
Nebraska Power Company,
Omaha, Neb.

To the Editor of the ELECTRICAL WORLD:

Regarding your editorial "Is Group Driving on Its Last Legs?" published in the Dec. 19 issue of the ELECTRICAL WORLD, we do not feel that group drive is on its last legs, and we do not anticipate that it will ever be done away with entirely. From the rather broad experience we have had in applying motors, extending over about fifteen years, we have found a great many cases where group drive seems to be preferable in many important respects and to be more economical, costing less for wiring and motors, and more satisfactory in operation.

I have in mind one particular case which came to my personal attention several years ago. We were equipping a large sheet-iron-pipe factory with motors. The factory was entirely new. A number of special machines were used for making galvanized-iron pipe for drain pipe, troughs, etc. The sheet iron was cut to proper size and fed through these machines in a continuous process. These machines were installed so that

there were about six in a group. According to tests, it looked as if each one ought to be equipped with a 3-hp. motor. We installed such motors and the wiring complete and found that the machines would occasionally stick and stall the motors. Then group drive was tried. It was found that a 7½-hp. motor would take care of the group under most operations and that a 10-hp. motor was ample for the entire group under all conditions. The machines all operated at the same time and the process was continuous, so there was little, if anything, to be gained by individual drive. For such an installation as this we would not recommend individual drive, unless it were a case where it was particularly desirable to do away with belts, line shafting and control levers.

Individual drive is still expanding rapidly and is being employed in a great many machines where group drive would be reasonably satisfactory. I doubt very much, however, whether group drive will ever be entirely eliminated, and I doubt the wisdom of trying to eliminate it entirely.

F. A. COFFIN,
Sales Manager.
Milwaukee Electric Railway & Light Company,
Milwaukee, Wis.

Secondary Wire Sizes and Lighting Feeders Regulated to a Median Voltage

To the Editor of the ELECTRICAL WORLD:

In the ELECTRICAL WORLD of March 20, page 609, Titus G. Le Clair emphasizes the desirability of maintaining at the regulated load center of a lighting feeder a median lamp voltage between the limits of allowable regulation. He suggests that smaller secondary wires might be used with this system of distribution. As his method is frequently used as a means for limiting the maximum range of voltage fluctuation at the lamps, it would perhaps be well to determine just what part the secondary wire size plays in securing maximum economy with this distribution scheme.

It was scarcely possible within the limits of the article on "Economical Wire Size for Lighting Secondaries," in the Feb. 27 issue, to take up all the assumptions and interpretations used in evolving the unearned-revenue formula. Apparently it was not made quite clear just what was meant by 100 per cent revenue. The revenue is assumed at 100 per cent when a lamp is allowed to burn at its rated voltage. When maximum voltage is maintained at the load center, the rated voltage is the one which the regulator is set to maintain at the central area and is also the no-load voltage for the feeder. For the median-voltage system the reference voltage is the highest allowable potential at the lamp nearest the station on the overcompounded section of the feeder (volts E in the formula). Voltage drop to any other part of the feeder is figured from this point.

With the median-voltage system there are three distinct areas. Consider a customer served directly from a transformer in each area, with secondary resistance negligible. A lamp at the regulated area, burning at the potential maintained at the meter, is kept as nearly at constant median potential as is practicable with the ordinary induction regulator. This potential, and consequently the revenue, is a little below 100 per cent. A similar lamp adjacent to a transformer at the end of a primary branch is supplied at median voltage during very light-load periods. At full load its potential and revenue depend on primary circuit drop. The potential of the lamp at the transformer nearest the station is overcompounded, i.e., median voltage at no load and overcompounded potential at full load. This lamp limits the voltage which can be carried on the feeder. If any attempt is made to raise its voltage more than a volt or so above rating, lamp life decreases at rather a high power of the voltage. Although a limited amount of "excess" revenue may be earned in this section, the average revenue on all the other lamps will be less at all times than it would be with maximum voltage at the load center.

Consider now a lamp at the end of a 1,000-ft. secondary from each of the three transformers. At the load center where the nearest lamp burns at constant voltage the lamp voltage and revenue of the lamp 1,000 ft. away are determined by economical secondary-line drop just as assumed in the formula. All lamps on secondary lines from transformers beyond the center of regulation have a potential controlled by primary drop plus economical secondary drop. But at no time will these lamps burn at full rated voltage. The lamp at the end of the secondary nearest the station has a potential equal to the overcompounded primary minus secondary drop. At certain intermediate points along secondary runs in this area will be lamp potentials where overcompounding equals secondary drop and lamps burn at median voltage. It is to this favorable effect of overcompounding that I assume Mr. Le Clair refers. But if, as he suggests, smaller secondaries be installed even in this favorable, though limited, area, the lamps at the ends of these low-voltage mains will operate at lower voltage and revenue than would be economical for the primary voltage available.

There are several operating disadvantages in the median-voltage system, but it is not my present purpose to argue for or against any particular scheme of regulation. The point I wish to make is that for the great majority of the customers secondary wire size does have a direct effect on lamp potential and revenue, whatever the primary voltage may be. The function of the regulator is to maintain a reasonably constant potential at some chosen point or area out on the feeder. In order to have this even potential extended over a reasonably wide area it is necessary to provide primary and secondary copper of sufficient size. The engineer may choose his voltage and the point he desires to maintain constant, but he has to depend on wire sizes to maintain this advantageous potential over the section to be served. Loss in revenue is proposed as a criterion for fixing the allowable investment in such copper. The unearned revenue formula and economical wire-size diagram were developed for this purpose. They determine the optimum potential gradient along the secondary main.

With reference to the assumption that the load is concentrated at the end of the feeder, the wire-size diagram may be applied to distributed load as outlined in the concluding paragraphs of the article on page 452. For secondary cribs economical circular mils per ampere may be computed for a point, perhaps 300 ft. or so, each side of the transformers. Space the transformers a sufficient distance apart to obtain this average current density. As the load increases install new transformers in between, or respace the old ones. By using this method, with a little care, it is practicable to maintain good voltage and reasonably economical operation without the expense and inconvenience of changing the copper.

H. S. LITCHFIELD,
Distribution Engineer.
Providence, R. I.

Central Station and Industrial Practice

High-Voltage Current Transformers Developed at Niagara

By L. C. NICHOLSON
Chief Engineer Niagara Electric Improvement Corporation, Buffalo, N. Y.

THE TYPE of current transformer here described was originally developed for use at Niagara Falls, where large short-circuit currents were to be provided for. A large number have been placed in service there during the last eight years and also on the lines of about fifty other power companies.

Fig. 1 shows construction and arrangement of parts. Insulation between primary and ground is obtained by supporting the primary winding on conventional type insulators and by providing suitable air clearance between primary and core on which the secondary is wound.

This construction has several advantages. For mounting on outdoor bus or switching structures, either upright or inverted, it is very desirable, since line wires or buses lead directly into and out of the transformer, resulting in simplified high-tension wiring. Horizontal spacing of transformers need not be more than normal spacing of line wires or buses. These transformers, if desired, can be mounted with insulators in horizontal position, which in some instances simplifies connections.

Freedom from the possibility of oil explosion or bushing failure is another marked advantage of this construction. Furthermore, the major insulation—viz., the air between primary and ground—is not subject to deterioration with time.

Ability to withstand heavy short-circuit current without suffering deformation or dangerous heating of windings is important. Since the primary coil is circular in shape, it is evident that there can be no bending produced in its turns by electromagnetic effects of heavy currents, because these forces tend to make the primary of circular contour. As the turns of the primary attract each other when carrying heavy current, there can be no explosion or deformation of this coil by short-circuit effects.

The cross-section of the primary copper is such as to provide several times the thermal capacity that is usually found in high-voltage transformers. The A.I.E.E. standards require current transformers to withstand 40 times full load current for one second without dangerous overheating. The Niagara current transformer is rated at 80 times full load current for one second and 40 times for four seconds.

This transformer is suitable for use on power measurements or for overload relay purposes, or for both in combination.

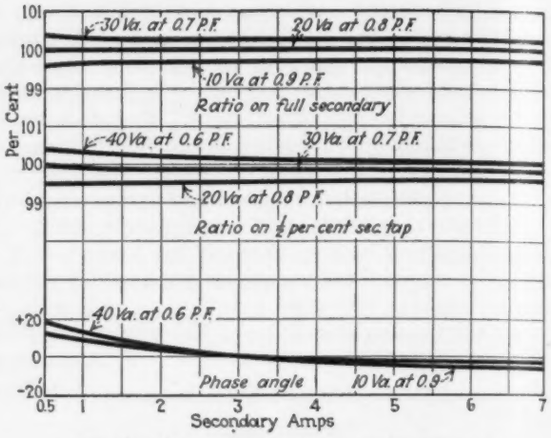
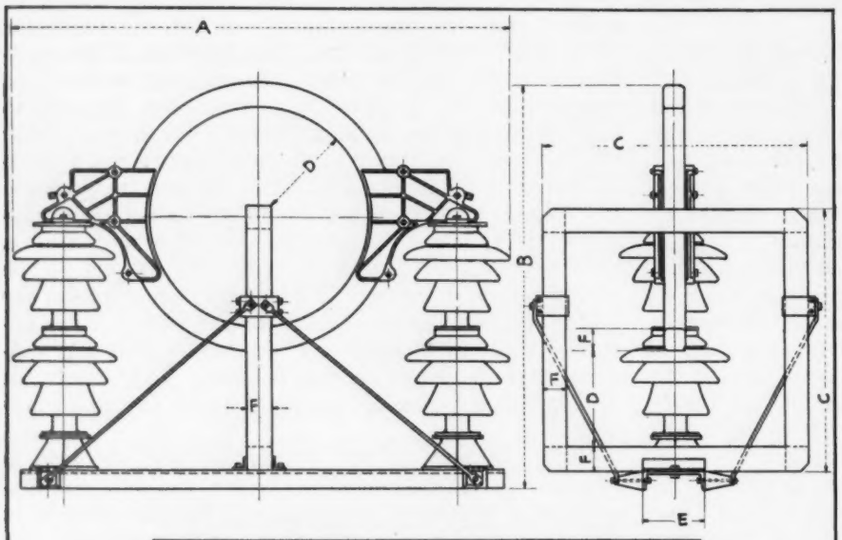

30 Va. at 0.7 P.F.
20 Va. at 0.8 P.F.
10 Va. at 0.9 P.F.
Ratio on full secondary
40 Va. at 0.6 P.F.
30 Va. at 0.7 P.F.
20 Va. at 0.8 P.F.
Ratio on ½ per cent sec. tap
40 Va. at 0.6 P.F.
Phase angle
10 Va. at 0.9
Per Cent
Secondary Amps

FIG. 2—RATIO AND PHASE ANGLE CURVES OF NIAGARA CURRENT TRANSFORMERS



Line Voltage	Dimensions A	B	C	D	E	F	Standard Insulators	Weight in lbs
22000	3-9½	2-10½	1-10½	6"	8"	3"	O.B. 11623 or 2 J.D. A-254	346
33000	4-4½	3-5½	2-9	8"	8"	3"	O.B. 12855 or 3 J.D. A-254	539
45000	4-9½	3-11½	2-7	10"	8"	3"	O.B. 12552 or 4 J.D. A-254	700
60000	5-6½	4-5½	2-11	12"	8"	3"	O.B. 26881 or Locke 9472	850
73000	5-10½	5-2½	3-5	1-3	8"	3"	2 Locke 8900 or 5 J.D. A-254	1250
88000	6-5½	5-11½	3-10½	1-6	10"	3"	2 O.B. 26085 or 5 J.D. A-254 and 1 J.D. A-258	1550
110000	8-7	8-5½	5-6	2-3	12"	4"	3 Locke 7185 or 3 O.B. 26333	2035
132000	8-7	8-5½	5-6	2-3	12"	4"	4 Locke 7185 or 4 O.B. 26333	2100

FIG. 1—DIMENSIONED DRAWING OF NIAGARA TYPE CURRENT TRANSFORMERS DESIGNED FOR HEAVY SHORT-CIRCUIT CURRENTS

UNUSUAL ACCURACY A FEATURE OF THE INSTRUMENTS

Typical accuracy curves are shown in Fig. 2. They indicate unusual accuracy for wattmeter measurements, especially at the lighter load currents. At any selected secondary burden (in these tests 20 volt-amperes at 0.8 power factor) the ratio is correct throughout the entire working range of the transformer—that is, from 0.5 to 7 amp.

secondary. Wide changes in secondary burden cause slight shifting of ratio curves, as is the case in any simple current transformer. If desired, this slight shifting can be compensated for by the use of a secondary tap, as shown in the lower set of ratio curves, where a ½ per cent secondary tap is employed for the heavier burdens.

ACCURATE RATIO CURVES OBTAINED BY ARRANGEMENT OF SECONDARY

Straight and accurate ratio curves are obtained by properly distributing the secondary winding on the core. If this winding is placed entirely on the upper half of the core, the ratio curve is very similar in shape to that given by a conventional type of transformer—that is, slow at light current and fast at full-load current. If, however, about one-third of the secondary is placed on the lower half of the core, an accurate ratio curve is obtained. Still further distribution of the secondary results in the transformer being slightly fast at light load and slow at full load. In other words, the shape of the ratio curve in this type of transformer is easy to control and fix at the time of manufacture.

Fig. 2 also shows phase angle curves at various loads. These results are obtained by a tertiary winding consisting of a few turns of resistance wire placed on the core at some point on the top member. This is a closed-circuited winding and is entirely independent of the other windings. It has the effect of decreasing the phase angle that otherwise exists (usually about 25 minutes more positive than shown in curves) and thus gives a ready means of controlling the phase angle at the time of manufacture. As shown by the curves, the residual phase angle throughout the working range of the transformer is small and, for the most part, negligible. This results in accuracy for wattmeter measurements when the power factor of the load being measured is less than unity.

As shown by the curves in Fig. 2, satisfactory accuracy for power measurements is obtained with a secondary burden of 40 volt-amperes. This represents a secondary circuit supplying induction-type relays and power-metering equipment.

As to ratio accuracy on heavy overload primary current, this type of transformer has good characteristics. For example, its ratio holds practically constant to beyond ten times full load current. From this value on, the secondary current decreases uniformly, so that at 30 times full load the secondary current is about 80 per cent of normal ratio value. Since overload current relays are set at less than ten times full load of the transformer, this requirement is fully met.

The kilovolt ratings, weights and dimensions of standard sizes are also shown in Fig. 1. The kilovolt ratings comply with A.I.E.E. standards for electrical apparatus of this class. Any of the usual ratios, either single or double, can be produced with equal facility. The insulators used are of standard manufacture and in case of breakage can be easily replaced by the user. All metal parts are hot-dip galvanized and the coils and core are thoroughly weatherproofed with a heavy roofing asphalt. The transformers are ruggedly constructed, and upward of eight years' service on various installations indicates satisfactory performance and reliability.

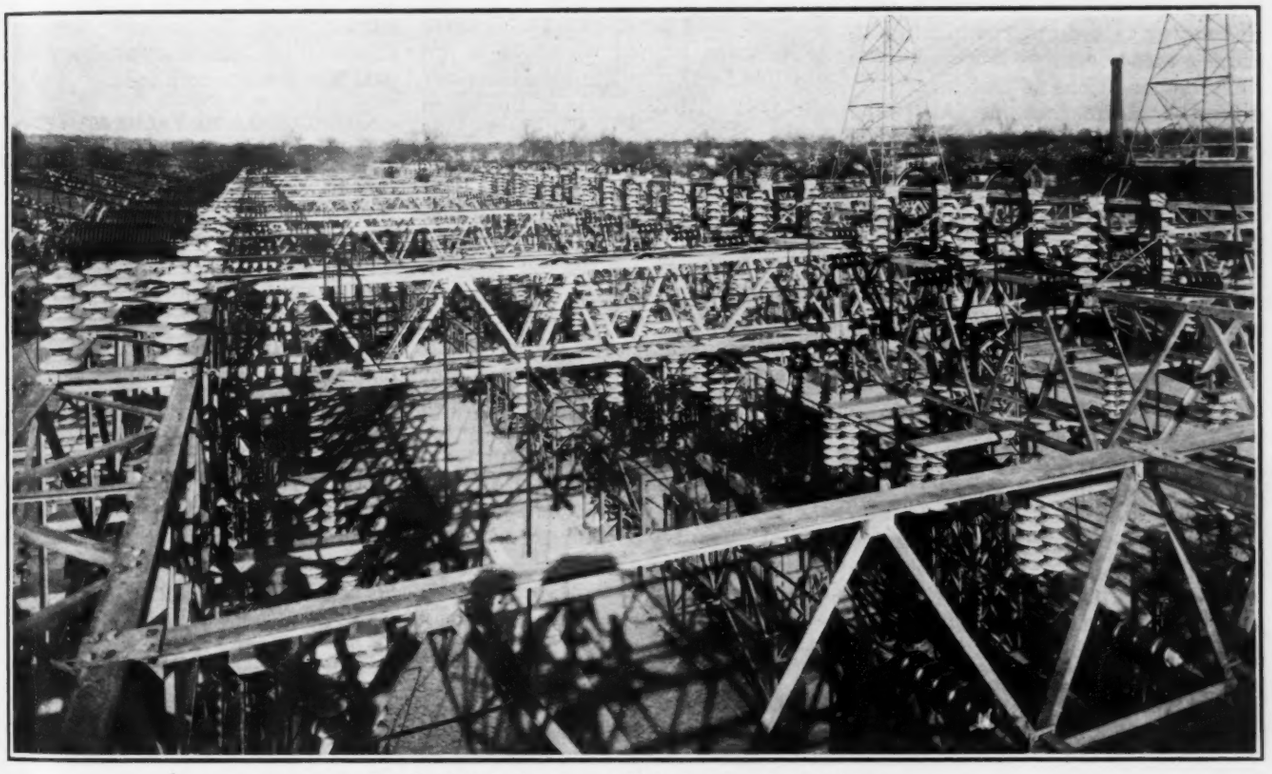


FIG. 3—NIAGARA CURRENT TRANSFORMERS INSTALLED

New Electrical Process for Defrosting Meat

IN VIEW of the oft-repeated statement that the meat output of the Western cattle country will soon have to be supplemented by reindeer beef from Alaska, the process described here may shortly be in actual and extensive use in Eastern cities. This method of defrosting has recently been introduced in Australia. It is specially designed to overcome the present disabilities in the marketing

of frozen meat and makes use of the generation of heat by the passage of an electric current through a resistance. A current of electricity is passed through the body of the carcass, and by this means the inmost portions are thawed before the outer layers. In order to avoid electrolytic effects alternating current is used.

The device consists of a number of electrodes made of stainless steel and mounted on fiber frames. These electrodes are driven into the carcass at points that give approximately uniform current density in both the thick and the thin portions. The energy is supplied through a self-regulating transformer, which maintains a steady current flow under the varying conditions of resistance during the defrosting period. The maximum voltage applied is about 200 and the maximum current about 1.5 amp. The consumption of energy for defrosting a hind quarter of beef is stated to be less than 3 kw.-hr.

As an additional advantage in favor of the new apparatus it is claimed that the process practically eliminates the drainage or drip from the meat, owing to the fact that the inner portions thaw before the outer, so that the outside frozen layers form a protecting seal. In addition, as the time of hanging does not exceed one day, deterioration is also reduced to a practically negligible quantity. The process has been patented by the inventor, A. U. Alcocks of Sydney, Australia.

Possibilities of Reducing Cost of Energy

12,000 B.t.u. per Kilowatt-Hour Seen as Immediate Limit with Present Steam Cycles, Better with Combination Cycles—Capital Expenditures and Coal-Handling Costs

POWER-STATION efficiencies are getting close to the ultimate possibilities of the steam cycle, declared W. S. Monroe, president of Sargent & Lundy, recently, so that further improvements will come only with great difficulty and at prohibitory capital expenditures. Undoubtedly it is impossible to go on reducing the coal rates indefinitely, he continued, and reckoned in British thermal units per kilowatt-hour there is a figure beyond which it is impossible further to improve the plant efficiency with any form of the steam cycle. Just what the base line is cannot be stated with absolute assurance of accuracy.

According to Professors A. L. Mellanby and William Kerr (who presented a paper before the English Engineering Societies last year), 1,250 lb. per square inch would be the ultimate limit of steam pressure. With this pressure and 90 per cent boiler plant efficiency they conclude that a theoretical fuel consumption of 9,400 B.t.u. per kilowatt-hour generated may be reached. However, their steam cycle contemplates an initial steam temperature of 900 deg. F. (which, Mr. Monroe points out, is quite impracticable with any metals available today), requires reheating the steam twice, first at 500 lb. and again at 180 lb., and nothing is said of the cost. Granting correctness of the figures and the practicability of the system, allowance for auxiliary power (and the percentage of auxiliary power goes up very fast with increase in pressure) and the difference between average operating efficiency and theoretical efficiency would indicate a possible average monthly plant efficiency in the neighborhood of 11,500 B.t.u. per kilowatt-hour output, Mr. Monroe contends.

Question as to Value of Very High Pressures

S. Z. de Ferranti of Manchester, England, whom Mr. Monroe considers one of the most able engineers on thermodynamics now living, has expressed the opinion that there can be no gain in going to a steam pressure of more than 850 lb. per square inch. The theoretical gain that can be achieved above this pressure is so small that the cost of getting it is more than likely to outweigh the percentage of improvement that can be accomplished. Until it is possible to obtain at reasonable cost metals that can withstand temperatures much higher than are now being used, probably the real limit of practical

Influence of Altitude on Electrical Equipment

(Abstracted from *A. E. G. Progress*, February-March, 1926)

Influence Exerted on	Corrections	Reason
Normal output of electric machines	Decrease the output above 3,280 ft. ½ to 1 per cent per 328 ft.	Deteriorated dissipation of heat due to losses
Normal output of air-cooled oil transformers	Decrease the output above 3,280 ft. ½ per cent per 328 ft. or increase the oil tank. Bushings are to be enlarged as on all hot-temperature apparatus	Deteriorated dissipation of heat
Working voltage of hot-temperature apparatus and overhead lines	Decrease in proportion to the density of the air	Decrease of the dielectric strength
Starters and rheostats	Usually no alteration; if necessary, increase ventilation	Dissipation of the heat due to losses
Cables	No alteration	———
Measuring instruments and relays	Recalibration of air vane damping for measuring instruments; magnetic damping for preference	Reduced air density
Energy required by compressors	Decrease the energy required ½ per cent per 328 ft., if volume delivered is to remain constant	Decrease of the air density
Energy required by fans	Unaltered	Rating according to the constant volume delivered

steam plant efficiency is somewhere between 12,000 and 13,000 B.t.u. per kilowatt-hour of output, and something less than 14,000 is now in sight with high-grade coal.

However, there are other methods of electric power generation that may be developed within a few years, points out Mr. Monroe, such as the combination mercury-vapor and steam-cycle advocated by W. L. R. Emmet, indicating the possibility of a station efficiency 20 or 25 per cent better than can be achieved by any form of steam cycle.

Fixed Charges and Coal-Handling Expenses

In the reduction of capital costs there is more opportunity for reduction of total operating unit costs so far as the immediate future is concerned, in Mr. Monroe's opinion. The reduction of fixed charges is as important as reducing operating charges. Reduction of power station costs means getting more capacity out of the turbines, generators, boilers and furnaces, as well as buildings. New developments in turbines, as well as in boiler and furnace construction, particularly for pulverized coal, indicate that a very material reduction can be made in the coming years in the cost of power stations.

Better methods in the handling and storage of coal and the handling of coal traffic with a view toward getting more continuous operation of the mines and improving the train schedules may also reduce by a considerable percentage the ultimate cost of coal at the power plant, suggests Mr. Monroe. It must be borne in mind that 10 or 20 per cent reduction in the cost of coal is just as good (except for the conservation of coal) as the same percentage improvement in plant efficiency. Furthermore, the cost of coal in the future is likely to have far more effect on the cost of electric energy than power station efficiencies.

Coal Distillation and Delivery Expenses

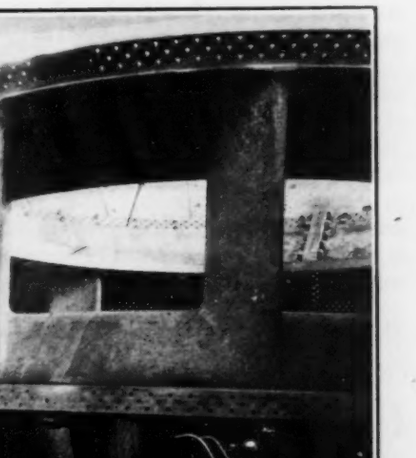
Preliminary or partial distillation of coal before burning the residue coke in the electric power station affords another possible and important opportunity for reduction of energy costs. Up to date, however, the cost of any coal-distillation process has been so high that the value of the byproducts would not pay for the operation of the distillation plant and of the refining plant that has to go with it, contends Mr. Monroe. This is particularly true in this country, where the cost of mineral oil and its byproducts are relatively low. The practical problem of coal distillation is a very difficult one, mainly because the heat conductivity of coal is very low and the time element involved in heating it to distilling temperature is a serious obstacle. However, much scientific effort is being put on this problem, and a cheap and simple method will doubtless be found. Coal distillation will require a closer association between electric and gas companies than has existed in the past. It holds the possibility of making gas at the coal mines for use in cities. Heat energy can be transported as gas through a pipe line for greater distances than electricity and at much less cost.

Since power station costs are only a part of the total cost of power to the consumer, there is an opportunity for further reduction in the cost of delivered energy by reduction of the other contributing factors such as transmission, substations, distribution, meters, connecting customers and general expenses.

Scroll Case for Cherokee Bluffs Unit

SINCE the turbines at the Cherokee Bluffs development are said to be the largest in the world next to those at Niagara Falls, it is to be presumed that the scroll case of the unit illustrated here holds a similar rating.

The initial installation made by the Alabama Power Company at this plant will consist of three 45,000-hp. units and an ultimate capacity of four units with a rating of 180,000 hp. The penstock pipe, scroll case and draft tube will be imbedded in mass concrete after assembly has been completed. This is the first construction of this type in the state, all other projects having been made only with concrete poured over wood molds.



GIANT SCROLL CASE FOR ONE OF THE 45,000-HP. UNITS BEING INSTALLED AT CHEROKEE BLUFFS, ALABAMA

Expediting the Re-fusing of Transformers

THE Empire District Electric Company of Joplin, Mo., serves Joplin and several smaller towns in southwestern Missouri. In some cases business sections are served by banks of four transformers, and at infrequent occasions a sudden overload, much greater than any normal load to be expected on the transformers, will blow the fuses. In order to cut the time necessary for re-fusing to a minimum a spare set of primary fuses is hung on the crossarm for the emergency and in some instances a disconnect switch is installed in the secondary, as shown in the diagram. With this switch out, two transformers can be fused at a time without throwing a heavy overload on the first two fused.

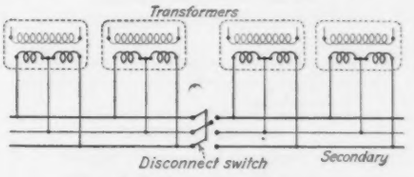
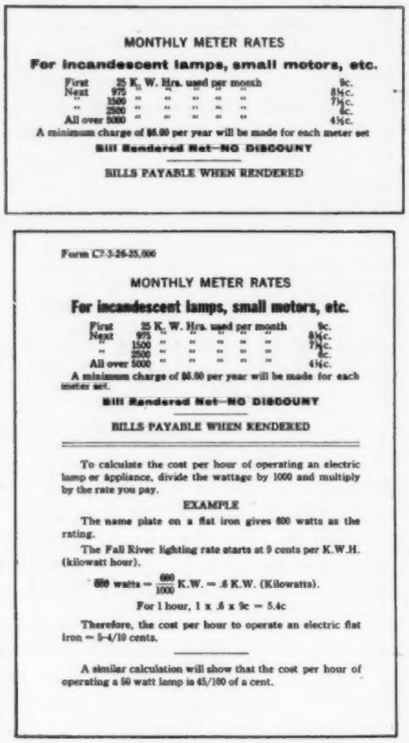


DIAGRAM OF DISCONNECT SWITCH INSTALLED IN SECONDARY FROM TRANSFORMER BANK

Commercial Activities and Public Relations

Fall River Helps Customers Compute Cost of Service

WITHIN the past few months the Fall River Electric Company, Fall River, Mass., has made an addition to its monthly bills, as shown in the accompanying illustra-



MONTHLY METER RATES

For incandescent lamps, small motors, etc.

First 25 K. W. Hrs. used per month 9c.
Next 975 " " " " " 8½c.
" 1500 " " " " " 7½c.
" 2500 " " " " " 6c.
All over 5000 " " " " " 4½c.

A minimum charge of $6.00 per year will be made for each meter set

Bill Rendered Net—NO DISCOUNT

BILLS PAYABLE WHEN RENDERED

Form C7-3-26-25,000

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To calculate the cost per hour of operating an electric lamp or appliance, divide the wattage by 1000 and multiply by the rate you pay.

EXAMPLE

The name plate on a flat iron gives 600 watts as the rating.

The Fall River lighting rate starts at 9 cents per K.W.H. (kilowatt hour).

600 watts = $\frac{600}{1000}$ K.W. = .6 K.W. (Kilowatts).

For 1 hour, 1 x .6 x 9c = 5.4c

Therefore, the cost per hour to operate an electric flat iron = 5-4/10 cents.

A similar calculation will show that the cost per hour of operating a 50 watt lamp is 45/100 of a cent.

OLD AND NEW BILLS OF THE FALL RIVER ELECTRIC COMPANY

tion, to enable its customers to apply the rates for electric service and compute the actual cost of operating various appliances and lamps. By calling attention to the small cost of operating lamps and appliances the company hopes to encourage the further use of electricity as well as to remove many doubts and misunderstandings from the customers' minds in regard to the service bills rendered.

Pittsburgh to Test Electric Heating for Homes

COMPLETE electric heating as well as cooking equipment and Red Seal wiring will be installed in 25 homes comprising a new housing development of the Westinghouse Electric & Manufacturing Company, which will be completed in September of this year. These houses will serve as test houses and will be sold to engineers of the company, who will conduct experiments to develop data on cost and efficiency of electric heating.

The Duquesne Light Company and the Armstrong Cork Company are cooperating in the installation, the latter company furnishing a complete cork insulation that is said to increase the efficiency of the heating equipment 30 per cent. It not only retains the heat in cold weather, it is claimed, but also keeps the houses cool in warm weather.

Five, six and seven room all-brick and brick and shingle houses will be built and sold to employees of the company at an average price of about $7,000 each, including the electric equipment. In addition to the heating system, the electrical installation will include ranges, refrigerators and water heaters, and the Red Seal wiring plan will provide for the most modern illumination and complete use of all other household appliances. This housing development is part of the general plan of the Westinghouse company to build 600 homes to be sold to its employees on easy terms, the total investment necessary being about $4,000,000.

Industrial Sales Department Organization

DURING the year 1925 the industrial sales department of the Union Gas & Electric Company in Cincinnati contracted for additional new loads that will bring to the company an increase in gross annual revenue of $1,028,000. Much of the success of this department's work may be attributed to a well-balanced plan of organization under which the various classes of industrial business are handled by separate divisions at the head of which are men who are specialists in that particular power application.

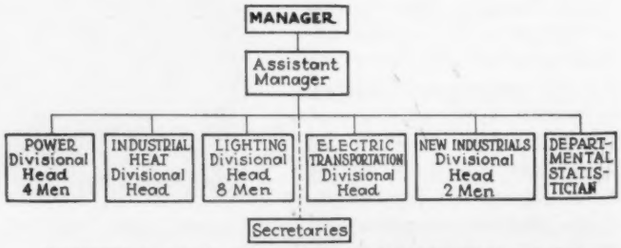
To show how each of these divisions functions, H. W. Derry, manager of the industrial sales department, has prepared an organization chart, as shown in the accompanying illustration. It will be seen that the commercial work is divided into six general headings: Power, industrial heat, lighting, electric transportation, new industries and statistical research. The number of men in each division in addition to the divisional head are also indicated. By this arrangement it is possible to assign to each a definite responsibility for following certain classes of business and prospective customers without overlapping or duplication of sales effort.

Utah Hospital Reduces Peak Cooking Demand 30 per Cent

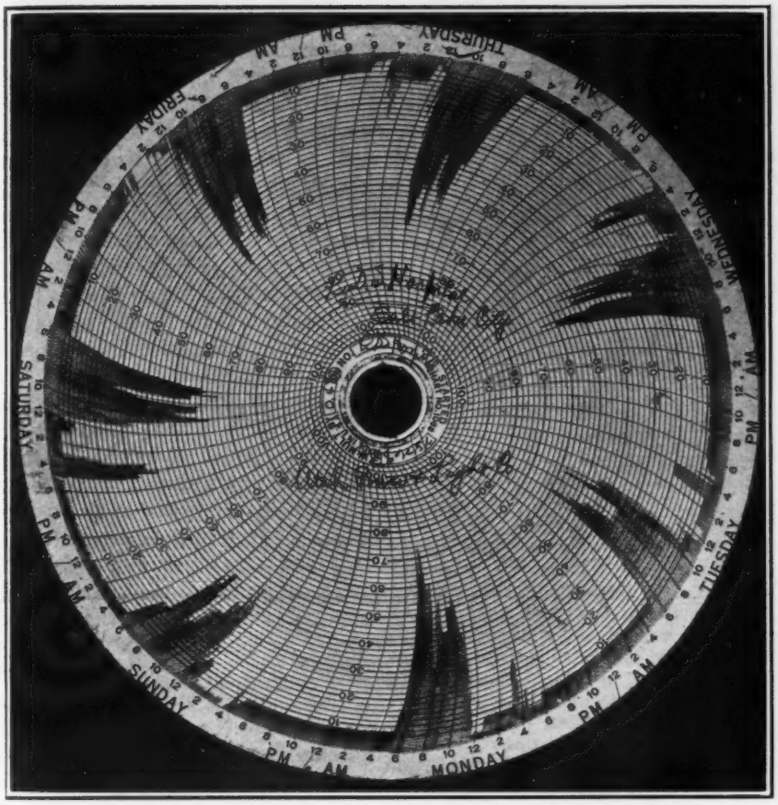
BY M. L. CUMMINGS, JR.
Utah Power & Light Company

CLEANLINESS, efficiency and economy are outstanding features in the successful operation of a hospital kitchen. The new Edison heavy-duty equipment that was recently installed in the Latter Day Saints' Hospital in Salt Lake City, Utah, is accomplishing remarkable results along this line. This institution is now using two hotel-type ranges, one baking and roasting oven, one 120-loaf bake oven and a sixteen-slice toaster.

During the month of February of this year this hospital was crowded to capacity, serving 36,000 meals, with a connected load of 67½ kw. and a demand of 35.4 kw. The average cost per meal amounted to 0.00334 cents, or 131 watts per patient. By placing the demand meter in plain sight of the chef, these results are being obtained. Off-peak hours are used to take care of the pastry bak-



INDUSTRIAL SALES DEPARTMENT ORGANIZATION CHART



WEEK'S COOKING LOAD CURVE IN SALT LAKE CITY HOSPITAL

ing, fat rendering and maintaining temperature for the next morning's run, thereby reducing the peak by this method of operation about 30 per cent. The accompanying chart presents a very interesting picture of the results that are being accomplished.

Oil-Burner Installations Average 177 Kw.-Hr. a Year

MORE than 5,000 electrically operated domestic oil-burners are in use for heating homes in Kansas City, Mo., according to an estimate made by C. F. Farley, vice-president of the Kansas City Power & Light Company in charge of domestic business. An accurate count cannot be given without a survey, as the $\frac{1}{20}$- to $\frac{1}{10}$-hp. motors used can be connected to the customer's service without notifying the utility company. About fifteen manufacturers are selling oil-burner equipment in Kansas City. Some of the installations have automatic temperature control and others manual control.

Energy consumptions by month for twenty of these installations are given in the accompanying table, which also shows the number of rooms in the dwelling. It may be observed that the curve of consumption over the year is about the reverse of domestic electric refrigeration, so that the two loads make a very good combination for utilizing the service investment to homes. The servicing is not handled by the utility company. Some flickering of lights has been caused by the motors starting, but it is of no consequence, says Mr. Farley. No study has been made of power factor effect yet.

Merchandising Practice in Southern Illinois

THE organization of the commercial department of the Southern Division of the Illinois Power & Light Corporation was described in the ELECTRICAL WORLD of April 3, page 720. This company has sold appliances for several years in its territory and carries on its merchandising on a self-supporting basis. Table I shows the form used for analyzing merchandising revenue and gives the distribution of expense in percentages. This division of expense covers all charges which should be made to merchandising and shows the actual status of the business.

Outside salesmen are employed on a straight 10 per cent commission basis and are paid commissions on all major appliances sold in their districts and on small appliances which they sell. Company records show that about 50 per cent of the small appliances are sold in the offices. No commissions are paid on lamp sales, though the outside salesmen sell a large number, and the

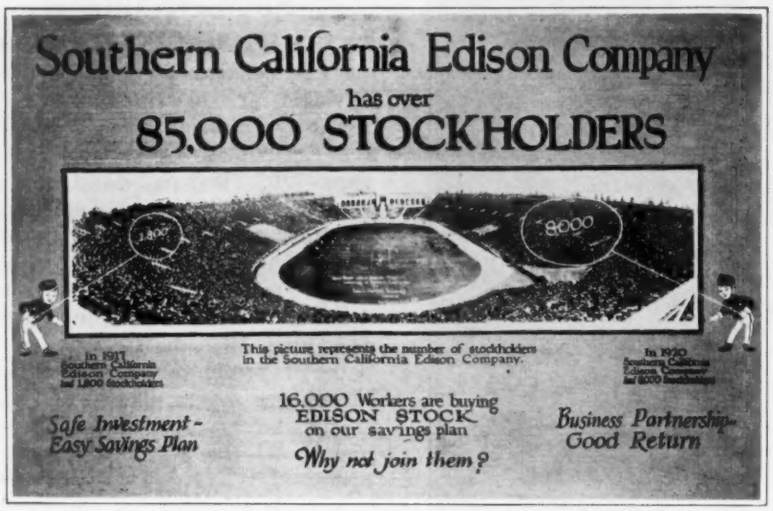
TABLE I—ANALYSIS OF MERCHANDISING COSTS IN SOUTHERN DIVISION OF ILLINOIS POWER & LIGHT COMPANY

	Per Cent
A. Cost of Goods:	
Cost of merchandise	59.00
Freight and cartage	6.00
B. Cost of installation, labor and material	5.00
C. Total cost of goods	70.00
D. Gross profit	30.00
E. New-Business Expense:	
1. New-business management salaries	1.20
2. New-business advertising salaries	.18
3. Demonstration	.42
4. Wiring and appliance	.36
5. Advertising supplies and expenses	3.10
6. Canvassing and soliciting	6.68
7. Miscellaneous new-business supplies and expenses	.06
Total	12.00
F. "D" less "E"	18.00
G. General and Miscellaneous Expense:	
Rental, heat and light	4.00
Insurance and taxes	.31
Uncollectible bills	.50
Clerical and collection salaries and expenses	4.00
Delivery	1.10
Repair and maintenance	.09
Total	10.00
H. "F" less "G"	8.00
I. Interest on investment and depreciation	2.00
Net profit or loss, "H" less "I"	6.00

CONSUMPTION BY MONTHS FOR TWENTY OIL-BURNER INSTALLATIONS IN KANSAS CITY, MO.

Installation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total Consumption
January	20	24	36	40	38	38	22	50	26	38	42	46	60	80	64	36	52	62	58	56	888
February	20	22	30	26	28	32	14	38	22	42	28	40	34	70	46	43	42	44	46	46	710
March	16	24	32	20	22	24	22	30	16	20	20	20	32	54	34	32	30	34	34	34	550
April	8	16	32	12	16	18	0	24	10	14	8	22	16	34	24	18	28	28	20	24	372
May	2	4	4	4	8	8	0	10	6	4	0	8	8	14	12	2	12	14	8	10	138
June	0	...	0	2	4	2	0	4	4	2	0	6	2	30	6	0	6	8	4	8	88
July	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0	0	....
August	0	0	0	0	0	0	0	0	...	0	0	0	0	0	2	0	0	0	0	0	2
September	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	2	2	0	10
October	2	...	0	2	4	6	0	8	0	1	0	2	8	2	2	0	2	6	6	4	55
November	4	4	18	6	8	8	4	6	4	4	12	8	10	8	12	2	4	12	26	6	166
December	20	12	30	26	20	18	12	33	12	16	46	38	32	52	32	26	22	34	58	26	562
Annual consumption, kw.-hr.	92	106	182	138	148	160	74	200	100	141	156	190	202	344	234	156	198	244	262	214	3,541
Number of rooms	4	5	5	...	6	6	7	7	8	8	8	8	8	8	9	13	12	12	12	15	....

Picturing the Growth of Customer-Owners


Southern California Edison Company
has over
85,000 STOCKHOLDERS
1,800
8000
In 1917 Southern California Edison Company had 1,800 Stockholders
This picture represents the number of stockholders in the Southern California Edison Company.
In 1920 Southern California Edison Company had 8,000 Stockholders
16,000 Workers are buying EDISON STOCK on our savings plan
Why not join them?
Safe Investment - Easy Savings Plan
Business Partnership - Good Return

ATTEMPTING to picture for the public the tremendous numbers to which its stockholder list has attained, the Southern California Edison Company uses the above layout and captions in the windows of its various offices. The original is 5 ft. long and 3 ft. 6 in. high. Busy Buttons on the left is pointing to an insignificant group of approximately 1,800 spectators in the stands at the 1925 Stanford-University of Southern California football game as representing the number of Edison stockholders in 1917. On the right a considerably larger group, approximately 8,000, is pointed to by Busy Buttons as the number of stockholders on the company's books in 1920. The center caption then completes the story by stating that the entire number of people pictured in the stadium, 85,000, represents the number of stockholders of the Southern California Edison Company today.

percentage of the gross sales expense charged to canvassing and soliciting is, therefore, reduced to 6.68 per cent. All employees of the company are urged to help sell appliances by furnishing leads to salesmen and, where possible, by actually completing the sale. Each salesman arranges a system of bonuses to fellow employees in his territory who furnish successful leads, and it has been found that this is a very successful method of furthering appliance sales and co-operation among employees. All the salesmen carry small kits consisting of pliers, screwdrivers and tape and make all small repairs to customers' appliances and wiring without charge. Any repairs which they cannot make are made at cost by the repair men.

Special campaigns on various appliances with long terms or cut prices have been abandoned. In place of them, special advertising plus a special bonus to salesmen has been adopted to push the sale of certain appliances at various times in the year. Premium offers of small load-building devices in connection with larger appliances have also been used at times with some success.

In order to get more small appliances on the line the company instituted a series of "cash and carry" sales during 1924. They usually took place on Saturdays and small inexpensive appliances such as percolators, toasters, curling irons, grills, etc., were offered on a strictly cash basis without delivery. All the articles were of the highest quality as far as the electrical parts were concerned but did not have the higher-priced materials and finishes. They could be offered at a list price, which permitted a fair profit, and still have an appeal to customers as a low-priced article which would be within the means of all customers and would be used more than the more expensive appliances. No appliances were wrapped up at these sales and it is believed that customers carrying the unwrapped appliances from the central station store stimulated interest in the sales.

Table II shows the sales per meter in 1922, 1923 and 1924, the number of major and small appliances sold and the distribution of major appliances. Although the amount in dollars and cents per meter fell off in 1924, there were more load-building small devices sold and a somewhat larger percentage of profit was made. The sales per meter figures include lamps, but are based on all meters in the division, including commercial and small power meters.

TABLE II—SALES PER METER AND APPLIANCES SOLD FOR 1922, 1923 AND 1924

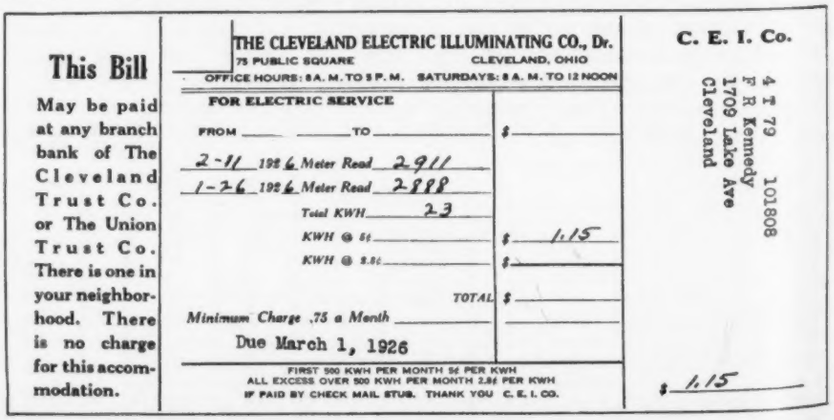
	1922	1923	1924
Sales per meter	$4.94	$6.47	$5.55
Washing machines	305	718	651
Vacuum cleaners	364	373	497
Electric ranges	29	41	70
Sewing machines	16	16	25
Total major appliances	714	1,148	1,243
Small appliances	2,808	3,329	4,118

During 1925 ironers and refrigerators were merchandised. In 1925 about thirty refrigerators were sold, but estimates for 1926 call for the sale of 300.

Customers Pay Light Bills at Branch Bank Offices

FOR its customers' convenience the Cleveland Electric Illuminating Company has arranged that all bills for electric light or power service may be paid at any of the branch banks of the Union Trust Company or the Cleveland Trust Company, which together have more than sixty branches in the city. Thus in effect the Cleveland Electric Illuminating Company has established numerous cashier's offices advantageously situated for payment of current bills.

The company, in mailing monthly bills, uses post cards on which attention is called to the fact that bills may be paid at the nearest branch of either trust company.


This Bill
May be paid at any branch bank of The Cleveland Trust Co. or The Union Trust Co. There is one in your neighborhood. There is no charge for this accommodation.
THE CLEVELAND ELECTRIC ILLUMINATING CO., Dr.
75 PUBLIC SQUARE CLEVELAND, OHIO
OFFICE HOURS: 8 A. M. TO 5 P. M. SATURDAYS: 8 A. M. TO 12 NOON
FOR ELECTRIC SERVICE
FROM TO
2-11 1926 Meter Read 2911
1-26 1926 Meter Read 2888
Total KWH 23
KWH @ 5¢ $ 1.15
KWH @ 2.8¢ $
TOTAL $
Minimum Charge .75 a Month
Due March 1, 1926
FIRST 500 KWH PER MONTH 5¢ PER KWH
ALL EXCESS OVER 500 KWH PER MONTH 2.8¢ PER KWH
IF PAID BY CHECK MAIL STUB. THANK YOU C. E. I. CO.
C. E. I. Co.
4 I 79 101808
F R Kennedy
1709 Lake Ave
Cleveland
$ 1.15

FORM OF POST CARD BILL USED BY CLEVELAND ELECTRIC ILLUMINATING COMPANY

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Fundamental Principles for Predetermining the Most Important Properties of Blowers.—FOLKE TENELIUS.—A discussion of the fundamental properties of blowers, particularly centrifugal blowers. The theoretical discussion consists in applying the fundamental equation established by Euler to various blower combinations. The formulas obtained in this manner should have great usefulness in discussing experimental blower data.—*Teknisk Tidskrift (Swedish) Mekanik,* March 20, 1926.

Generation, Control, Switching and Protection

Practical Experience from Parallel Operation of Power Stations.—S. VELANDER.—The author describes some of the results obtained from parallel operation of about 30 power stations in the southern part of Sweden. The author places special emphasis on the fact that this parallel operation contributes to an appreciable improvement in the average efficiency of the water turbines. It is a very significant fact that for Swedish conditions 1 per cent improvement in the efficiency of the hydraulic stations is fully as useful as 9 per cent improvement in the efficiency of the steam plants. One important detail in the improvement of the water economy is the method of adjusting the turbines for a certain throttle opening instead of a certain load. The throttle opening is indicated on a large dial, visible over the entire turbine room, and this dial also indicates whether or not the turbine is operated at its most efficient load. As a result of improvements of this kind the author has observed an increase in over-all efficiency for a group of power stations of from 65 per cent to 80 per cent.—*Teknisk Tidskrift (Swedish), Elektroteknik,* March 6, 1926.

Transmission, Substations and Distribution

Experimental Study of the Possibility of Fifth and Seventh Harmonic Resonance in Transformers.—A. BOYAJIAN.—It has been suggested that the high flux density used in modern transformers might give rise to harmonic currents and voltages of such magnitude as to prove troublesome. The transformer might then be considered as a generator of higher-frequency currents or voltages, leading to disturbances in the parallel circuits consisting on the one side of the main generator and transformer primary impedances and on the other side of the transformer secondary impedance and line capacity. If the reactances of these two circuits are numerically equal and of opposite sign, there exists a condition of parallel resonance, and the combined circuit offers maximum impedance to the flow of current, resulting in the appearance of a corresponding voltage impressed on the line capacity. Under slightly different conditions there may be series resonance between the transformer secondary reactance and the line capacity, permitting the flow of currents of appreciable magnitude. To investigate these possibilities equivalent circuits were set up and the constants determined experimentally with the aid of an oscillograph. The curves obtained, some of which are reproduced with the article, show the distortion of the current and voltage waves. Some of the conclusions are as follows: (1) The fifth and seventh harmonics were entirely too small to constitute any risk whatever to the apparatus, the maximum fifth or seventh harmonic voltage that could be produced being only 13 per cent of the fundamental, even at 15.6 kilogausses. (2) The maximum resonant fifth and seventh harmonic voltages were of about the same order of magnitude at the lower as at the higher densities over the more common range, say between 9 and 13 kilogausses. (3) With respect to telephonic interference the resonance values are large enough to produce serious trouble under adverse conditions at very low as well as at high densities; the problem of interference cannot therefore be solved by restricting the flux density in the transformers. (4) Any large resonance can only occur with a pure charging current, with no power load connected to the line, and then only if the charging current is of a particular value; since it can occasion no harm and only a preventable temporary interference to telephony, no ground seems to exist for serious apprehension of interference from harmonics of the exciting currents alone.—*General Electric Review,* March, 1926.

Illumination

Lighting for Recreations.—J. H. KURLANDER.—This revision of an earlier bulletin contains data and suggestions on the illumination of spaces for various kinds of indoor and outdoor recreations. With the inclusion of football fields, clock and court golf courses and toboggan slides, it would seem that provision had been made for every kind of activity that does not demand bright light over an extraordinarily large area, such as a baseball field or a golf course. The increasing intensities now regarded as desirable are well illustrated by the case of tennis court lighting, for which the present recommendation is four 1,500-watt lamps. The old figure was four 1,000-watt lamps. Some of the intensities given in a table at the end of the booklet may well be quoted. The first value in each instance is the recommended intensity in foot-candles, the figures in parentheses being the suggested range: Clock golf courses, circus arenas, motordrome tracks, football fields, dance halls, 4 (2 to 6); bowling alleys, on the pins, billiard tables, racquet courts, tennis courts, handball courts, 15 (10 to 20); boxing rings, amateur, 20 (10 to 30), professional, 50 (30 to 100).—*Bulletin LD 126A, Edison Lamp Works.*

Unattended Electric Lights for Navigation.—A. W. TUPPER.—Aside from lighthouses, thousands of lesser lights mark the channels or give warning of obstructions in our navigable waters. These should be capable of unattended operation for long periods. A type of primary-cell flashing light has been developed which is automatic, reliable, relatively simple and adjustable as to the cycle of flashes. It consists of a small insect-proof lantern having a 6-in. Fresnel lens, a ½-amp., 10-volt electric lamp, fourteen to sixteen Edison primary cells and a flasher. The battery will operate the single flash at about 30 times per minute and one-fifth second duration for some 320 days before it is exhausted.—*General Electric Review,* March, 1926.

Motors and Control

Correction of Power Factor by the Use of Synchronous Motors.—PHILIP CHAPIN JONES.—In addition to an explanation of the function of synchronous machines in correcting the power factor of a circuit, charts are given showing (a) the minimum capacity of synchronous motors required, in terms of the total load, to provide a given corrective effect, and (b) the excess capacity required when the motor is operated at some power factor other than the optimum.—*Electric Journal,* March, 1925.

Heat Applications and Material Handling

Electric Furnaces.—T. METZGER.—A general review is given of the various electric furnace types which are used today for melting non-ferrous metals and alloys. According to a census of recent date, there are 600 of these furnaces in operation in America and 180 in Europe. The paper describes single-trough and double-trough induction furnaces, the "Ajax" type, the revolving-arc type and the high-frequency furnace. A detailed operating and maintenance cost tabulation is given for an Ajax brass furnace, with an output of 80 tons per day, as compared with a coke-fired crucible equipment. The final cost figure per ton of finished castings is, in this example, 55 marks for electric operation and 76 marks for the coke furnace.—*Zeitschrift des Vereines Deutscher Ingenieure,* March 13, 1926.

Electric Thermostat.—A SCHERBIUS.—Existing bimetallic thermostats are limited to a rupturing capacity of about 30 watts, which is sufficient to warrant their extensive use on heating pads and for all such purposes where the amount of current to be broken does not exceed this wattage. The new thermostat described in this paper is capable, it is claimed, of breaking up to 900 watts. Its essential elements are a bimetallic strip with tungsten contacts inclosed in a small glass cartridge, which is evacuated. The entire unit is only about 2½ in. long and resembles a small cartridge fuse. The thermostat must be adjusted to the desired temperature range before it is sealed in. Built into flatirons, etc., such a unit will effectively prevent

dangerous overheating. It is also possible to equip the unit with an electric heating coil, in which case the thermostat will act indirectly and can replace a temperature-controlled time-delay relay. The cost of such a relay will be materially less than that of the customary electromechanical relays. The author maintains that the further development of electrical heating appliances depends today essentially upon a reliable, small and inexpensive thermostat, of which the type described is an example. — *Elektrotechnische Zeitschrift*, Feb. 25, 1926.

Remote Control Without Pilot Wire. —J. REYVAL.—This paper describes a method whereby any number of signals can be transmitted over power wires without interfering with the service. With properly designed and tuned receiving relays, these signals can be picked up at any desired point of the network, where they can be utilized to actuate certain operations, such as, for example, connecting or disconnecting street-lamp series. The principle of the method is to impress alternating current of 500 to 1,000 cycles per second upon the lines, which carry either direct current or 60-cycle alternating current. At selected points relays are installed, which not only respond to the high frequency but which also integrate and act upon certain numbers and intervals of impulses. In this manner various relays, all connected to the same power system, can be made to perform a variety of operations, entirely independent of each other. Among the many applications of this system are mentioned the rate change of meters, street illumination, adding transformers to the line during peak load periods, pumping stations, etc.—*Revue Générale de l'Electricité*, March 6, 1926.

Electrophysics, Electrochemistry and Batteries

Electrical Properties of Rubber.— H. L. CURTIS and A. T. MCPHERSON.— The paper presents the results of studies of the dielectric constant, power factor and resistivity of rubber and its compounds and of gutta percha. Crude rubber has a lower dielectric constant than either gutt percha or vulcanized rubber, the value for the latter depending on the conditions of vulcanization. Sample figures are: For crude, from 2.38 to 2.70; for 96 per cent rubber and 4 per cent sulphur, two to three hours' vulcanization, about 2.90; 92 per cent rubber, about 3.30 to 3.50. Vulcanization by sulphur alone produces a higher dielectric constant than vulcanization with the aid of an accelerator, and the addition of a filler also increases it, sometimes by 200 or 300 per cent. Vulcanization increases the power factor, but the increase is less with an accelerator than with sulphur alone. The addition of quartz decreases it, but most fillers increase it. The power factor of gutta percha is higher than that of gutta, its hydrocarbon, the amount depending on the amount of resin present. Crude and vulcanized rubber and gutta percha all have about the same resistivity, but this property varies between rather wide limits, figures ranging between 15 and 180 $\times$ 10^{14} ohms per cubic centimeter being noted in the report. The incorporation of some substances, notably litharge, in certain proportions in vulcanized rubber increases the resi tivity, but carbon has the opposite effect. The effect of an increase of pressure, on which tests were carried up to 10,000 lb. per square inch, is generally to increase the dielectric constant by a few per cent, and to increase the power factor in slightly larger ratio, the average for the latter being around 10 per cent.—*Technologic Papers of the Bureau of Standards*, No. 299.

Temperature Coefficient of Magnetic Permeability of Sheet Steel.—T. SPOONER.—Tests were made on commercial sheet steel, as used in electrical apparatus, containing 0.9 to 4 per cent silicon. The conclusions drawn from these tests are: (1) Low and medium silicon steels have large positive permeability temperature coefficients for low inductions and negative coefficients for high, up to 14 kilogausses; 4 per cent silicon sheet has on the average negative coefficients for all inductions, though individual samples may have small positive coefficients for low inductions. (2) As the silicon content increases the coefficients tend to move in a negative direction; the shape of the temperature coefficient curves seems to be much more definitely a function of the induction than of the mmf. (3) There seems to be no definite relation between permeabilities and temperature coefficients for the individual samples of a particular grade of a material and no definite relation between the induction at which maximum permeabilities and maximum temperature coefficients occur. For an induction of 10 kilogausses, corresponding quite definitely to maximum negative temperature coefficients, the permeability μ_t at temperature t in terms of μ_{20}, the permeability at 20° C, is approximately expressed by the formula

$$\mu_t = \mu_{20}\,(1 \pm a_{20}\,(t - 20))$$

where a_{20} = —0.00023 for 0.9 per cent silicon, —0.00086 for 2.2 per cent silicon and —0.00177 for 4 per cent silicon. —*Physical Review*, February, 1926.

Traction

Chicago Terminal Electrification on the Illinois Central—D. J. BRUMLEY.— Of the seven systems originally considered for the Chicago terminal electrification all but two were early eliminated. Comparison of the 1,500-volt direct-current and the 11,000-volt alternating-current systems led finally to the selection of the former as best meeting local conditions. Work has now progressed to the extent that suburban service is to begin in July, main-line electrification to follow later. The present article contains a technical description of the track and overhead structures, rolling stock, and passenger station.—*Engineering News-Record*, Feb. 27, 1926.

Control Equipment in Operation on Staten Island Rapid Transit Cars.— FRANK GUILLOT.—Multiple-unit trains consisting of from one to five cars are operated on the line in question. Control energy for the motor controller is obtained from a 32-volt storage battery, the main motor contactors being actuated by a series of cams driven by a rack and pinion connected to an air engine. The control equipment is briefly described and illustrated in the present article.—*General Electric Review*, March, 1926.

Telegraphy, Telephony, Radio and Signals

Performance of Amplifiers. — H. A. THOMAS. — The paper, based on researches at the National Physical Laboratory, describes a standard method of testing the amplification and input impedance of an amplifier. It is shown that on account of interelectrode capacities, stray-load capacities and leaks large variations in the high-frequency amplification may exist between amplifiers built to similar specifications. Also, the amplification depends upon the frequency; thus, a case is given in which it falls rapidly below 4,000 m. because of the shunting effect of the capacity of the anode resistances. As against the assumption that if the valve is operated with no grid current and upon the linear part of its grid-voltage anode current characteristic, the output wave form is sinusoidal if the applied voltage is sinusoidal, severe discrepancies have been found between the indications of a root-mean-square instrument and those of a vibration galvanometer which measures the amplification of the fundamental only. This indicates that harmonics of very appreciable magnitude exist in the output current. The audible strength of the signal seems to depend on the peak value of the wave. The presence of harmonics may therefore be no disadvantage for telegraph signal reception, but it must be limited if good telephonic reception is to be had.—*Journal of I.E.E. (British)*, February, 1926.

Need for Steadiness in Transmitter Frequency to Prevent Interference Effects.—L. B. TURNER.—Under the general caption "Notes on Wireless Matters," the author shows that, in view of the congestion of wave lengths which has forced the interval between frequencies of different stations in some instances down to 200 cycles, extreme stability of continuous-wave frequency is essential to successful reception of signals. Variations as great as 20 cycles will, in heterodyne reception at 200 cycles produce a warbling note fluctuating in both pitch and intensity that cannot be read through the interference of the warbling note from another station giving a beat note hovering around 400 cycles. The results of an experimental method for measuring the fluctuations, recently published, are quoted. According to this method, the station under observation is made to produce a beat note of about 1,000 cycles per second with the aid of a heterodyne oscillator of unimpeachable constancy and the acoustic current passed through an oscillograph, together with current from another local oscillator differing from the 1,000 cycles by 50 to 80 cycles. Beats of this frequency are thus produced. Variations can be accurately measured. Studies were made on 39 stations in Europe, of which five exceeded what the authors regarded as the greatest permissible wandering, namely $\pm$ 10 to 12.5 cycles. —*Electrician (England)*, March 12, 1926.

News of the Industry

New Boundary-River Plans

American Superpower Corporation Would Spend $300,000,000 on Niagara and St. Lawrence

LIGHT was thrown this week on what had been a somewhat obscure application from the American Superpower Corporation to the New York State Water Power Board for a permit to undertake a hydro-electric development on the St. Lawrence River, when letters from the president of the corporation to Secretary of State Kellogg and United States senators were made public. From these it appears that Henry L. Doherty, New York, has been elected chairman of the board of the American Superpower Corporation; A. B. Leach, New York, chairman of the executive committee; Edward C. Randall, Buffalo, president; F. C. Hamilton, New York, vice-president, and J. Boardman Scovell, Lewiston, secretary.

The plans of the corporation, which are predicated upon an early amendment to the existing treaty between Canada and the United States by which more power might be developed by both countries at Niagara Falls and on the St. Lawrence, call for a development at Niagara Falls to cost $88,000,000 and a development in the St. Lawrence to cost $211,500,000.

The corporation will offer to install remedial works at the crest of the Horseshoe Falls to stay the natural recession of the cataract if the Federal Power Commission grants it a license to divert such waters of the Niagara as may become available under the proposed amendment to the international treaty. The expense of this undertaking would be borne by the corporation jointly with the Ontario Hydro-Electric Commission.

In addition to the Niagara project the corporation has filed applications with the Federal Power Commission and the Water Power Commission of the State of New York for permission to develop power on the St. Lawrence. This plan provides for a channel for navigation by oceangoing steamers with a draft of 30 ft. In case the canal is included in the project, the American government would be asked to contribute $28,700,000. A hearing before the state commission is scheduled for May 6.

Applications Before Federal Power Commission

L. R. Jorgensen has applied to the Federal Power Commission for a license covering a project on the Middle Fork of Feather River in Plumas County, Cal. Since April 19, 1923, Mr. Jorgensen has been investigating the project under a preliminary permit. He proposes to build five dams. One of these, the Grizzly Valley Dam, will create a reservoir covering 4,700 acres. About 46,000 hp. of primary power will be developed. It is planned to install 75,000 hp. at three power houses.

The Sierra & San Francisco Power Company has applied for a license covering its Melonis project on the Stanislaus River in Calaveras County, Cal., where it is planned to install 34,000 hp.

The Minnesota Power & Light Company of Duluth has applied for a license covering its partly constructed project on the Isabella River in Lake County.

The Utah Power & Light Company has applied for a license covering its partly constructed Paris Creek plan in Bear Lake County, Idaho.

The California-Oregon Power Company of San Francisco has applied for a license covering a 38-mile transmission line connecting its Fall Creek power house and Klamath Falls.

The Sultan Electric Company of Sultan, Wash., has applied for a preliminary permit covering a project on Lake Isabelle and May Creek in Snohomish County.

Barry Dibble of Redlands, Cal., has applied for a preliminary permit covering a project on Rock Creek in Twin Falls County, Idaho. He proposes to erect a 60-ft. dam. He also has applied for a preliminary permit covering a project on Snake River, where he plans to erect a dam 120 ft. high.

The preliminary permit of the Mineral Range Power Company of Columbus, Mont., has been extended for one year to Feb. 7, 1927.

The Wabash Hydro-Electric Company of Indianapolis has applied for a preliminary permit for a project on the Wabash River near Logansport. This application conflicts with that of John A. Shafer, to whom a preliminary permit was issued June 26, 1924.

The Wisconsin Power & Light Company of Madison, Wis., has applied for a preliminary permit covering a project on Wolf River in Shawano County, Wis. The primary power available is 2,560 hp. It is proposed to install three units with a total capacity of 3,200 hp.

Muscle Shoals "Put Up at Auction"

On President's Suggestion, Applicants Are Asked to Bid Against One Another—Cyanamide Company's Offer as Viewed by Some Indicates Rivalry for Power

By PAUL WOOTON
Washington Correspondent ELECTRICAL WORLD

ACTING on the suggestion of the President, the negotiations for Muscle Shoals have taken on the form of an auction. Those who have submitted offers have been called in and are being asked to overbid the others. The President's opposition to any plan which will require further expenditures by the government also has injected a new factor into the negotiations.

It is apparent that the full influence of the farm block is behind the American Cyanamide Company's offer. It is being represented by some that the struggle is between the farmers and the power interests. Others point out that no one of the bidders is sure enough as to nitrogen manufacture to pledge very much in the way of fertilizer, so that the farmer has little chance of being an important beneficiary of any offer. Some see in the negotiations efforts on the part of two competitive groups of power companies to gain an advantage each over the other. Those holding this view argue that as the Cyanamide company is a Duke interest it is greatly interested in power. To gain a foothold on the Tennessee River would be a protection against inroads from the south into the field now being served by the Duke companies.

To offset the farmer support for the Cyanamide offer, the Alabama Power Company and the companies associated with it in the offer for Muscle Shoals seem to have important labor support from those interested in the growth of industry in the states which they serve.

The Union Carbide Company has made public some of the conclusions it has derived from investigations of the Muscle Shoals problem. That company believes that Nitrate Plant No. 2 is far from obsolete. It believes that the national defense can be furthered greatly through the establishment of local electrochemical and electrometallurgical industries at Muscle Shoals. It also has gone on record to the effect that hydro-electric power "can be made available in reasonable amounts for general distribution beyond the needs of national defense, agriculture and local industry."

N.E.L.A. Invites Europeans

Visiting Technicians May Remain for Atlantic City Convention—Big Exhibition Assured

AMONG the distinguished people invited to the forty-ninth convention of the National Electric Light Association at Atlantic City, May 17-21, are the President of the United States, members of the Cabinet, governors of the states, and the delegates, representing thirteen foreign countries, to the International Electrotechnical Congress, just over at New York, who will return to that city from an extended tour about May 5 and many of whom are expected to defer sailing in order to attend the convention.

The exhibition to be held in conjunction with the convention will be

by far the most elaborate in the history of the association. All available space for exhibition purposes on the great Million-Dollar Pier has already been reserved. This exhibition will be of a character that will warrant close study by convention delegates, who are being urged by President Davidson to arrive in Atlantic City by the Saturday or Sunday preceding the convention so that they may have all of Monday to inspect the exhibits.

In addition to the main auditorium on the Million-Dollar Pier, where the major part of the program will be given, and the auxiliary meeting rooms, where the parallel sessions of the national sections will be held, other special rooms for association activities will be opened during the convention. These will be the executive offices, the registration rooms, information department and publicity department, all of which will be at the end of the pier nearest the boardwalk. On other parts of the pier will be booths of the industrial lighting committee, the Commercial National Section, the educational committee, the customer ownership committee, the domestic cooking and heating committee, the service department and department of public information, exhibits of public utility advertisements, public relations literature, etc. The women's committee will have a booth under the direction of Miss Elizabeth Lee, chairman, and Miss Isabel Davie, secretary. At this booth women attending the convention can meet informally for discussion.

I. E. C. Has a Busy Week

Excellent Results Follow Hard Work at the Technical Sessions of the Advisory Committees—Visitors Enjoy Lavish Hospitality —Inspection Tour Follows Meeting

NUMEROUS standardization sessions, inspection trips and many social events kept the delegates attending the International Electrotechnical Commission sessions at New York City very busy this week. The display of abundant American hospitality culminated at a banquet on Monday at the Hotel Astor, when Gano Dunn, past-president of the American Institute of Electrical Engineers, acted as toastmaster and a large audience listened to addresses from several speakers.

Mayor James J. Walker of New York welcomed the delegates, and Dr. Guido Semenza, president of the commission, responded to the greeting. Representatives of different nations then spoke on the work of international standardization and its value. Dr. Semenza said that although this work might be done with a wholly selfish national viewpoint, yet its results would happily make for international benefit and good will. Other speakers were E. Uytborck, chairman of the Belgian delegation; Prof. C. Feldmann of Holland, president of the Dutch Electrotechnical Committee; Domingo Santa Maria of Chile, who spoke for South America; E. Huber-Stockar, president of the Swiss Electrotechnical Committee; Sir Richard Glazebrook, president of the British National Committee, I.E.C., and John W. Lieb of New York. Prof. Luigi Lombardi, president of the Italian Electrotechnical Committee, extended an invitation to the scientists to hold their next annual meeting in Rome.

Many expressions of thanks for the generous hospitality afforded the delegates were heard, and Mr. Lieb, the chairman of the reception committee, and Frank W. Smith, who shared with him the responsibility for the discharge of this important task, were praised for the thoroughness and success of their zealous efforts.

On Wednesday evening the International Electrotechnical Commission as a body entertained the American hosts at another delightful banquet, also held at the Hotel Astor. Dr. Guido Semenza presided at the banquet and in his opening remarks again complimented Messrs. Lieb, Smith, Clayton H. Sharp, president of the United States National Committee of the I. E. C., and the other members of the various American committees, saying that the completeness of the organization for the delegates' entertainment had served to spur them to unusually good results in their committee work. As a token of appreciation and gratitude Dr. Semenza presented on behalf of the visitors a beautiful statue of Nike, the winged Goddess of Victory.

PRESIDENT GUIDO SEMENZA

Dr. Sharp responded for the American committee and thanked the visitors for the emblem of friendship, expressing the hope that some day the United States would again have the privilege and pleasure of entertaining the commission. Representatives of the different nations were then called upon, and each expressed felicitously the common sentiment of pleasure and appreciation.

Following the adjournment of the convention the foreign delegates left on the scheduled tour of the eastern United States and Canada.

Proceedings of the Plenary Meeting

The plenary meeting of the International Electrotechnical Commission was held on the afternoon of Wednesday, April 21, in the Engineering Societies Building. For the information of those who are not familiar with the business procedure of the commission, it should perhaps be first explained that the work toward bringing the practices of different countries into accord is done by advisory committees in the commission, each committee undertaking a definite assignment and being composed of representatives of the national committees of the countries concerned or interested. These advisory committees make reports of the work accomplished by them to the plenary meeting of the commission, where action of approval or disapproval is taken, the findings of the committees being then published for promulgation.

The plenary meeting was opened by President Semenza, who said that there never had been such a successful meeting of the commission before and that he thought this result was due in large measure to the detailed preparations which had been made by the American hosts and which inspired good work from the delegates in return.

Following Dr. Semenza's remarks, C. le Maistre of London, general secretary of the commission, expressed his happiness in welcoming the return of the German delegation to the international technical brotherhood and announced that the standardization body of Australia had asked for admittance and had been received into the commission. He further announced that President Guido Semenza had been re-elected by acclamation, that Colonel Crompton had been promoted from honorary secretary to honorary president, and that Sir Richard Glazebrook had been appointed to the office of honorary secretary vacated by Colonel Crompton. He said that the next meeting would be held in the summer of 1927 and that acceptance had been given to the invitation of the Italian National Committee to meet at Rome.

COMMITTEE REPORTS

The first committee to report was that on nomenclature, of which President Semenza was chairman. The committee recommended that the commission continue its work in this direction to bring all countries into agreement on the precise meanings of words and phrases used in the electrical art. It advised that the lately completed British electrical glossary be used as a basis on which to build comparisons and agreements and that it be circulated among the various national committees to that end. In order to give the Slavic languages a representation in this important work, the advisory committee on this subject was enlarged to include Russia, with Professor Châtelain as delegate.

One of the very important occupations of the International Electrotechnical Commission, if not the most important, is the standardization of ratings of electrical machinery. The value of the work of the rating com-

mittee is most apparent in international trade in electrical equipment. Without recognized dicta in regard to ratings, this international business has been in the past, and is even now to large extent, involved in wasteful and irritating difficulties. The report of the rating committee was read by the chairman, Professor Feldmann, and is here summarized very briefly, the reader's attention being directed to the able article by F. D. Newbury, which immediately follows this report.

TEMPERATURE RATINGS FIXED

The first item of the rating committee's report dealt with temperature rises in the rotors and stators of machines of different types and designs according to the kind of insulation used. It was specified that temperature measurements should be made in rotors by the resistance method and in stators by the embedded temperature-detector method. The next item described the permanent installation of these detectors—thermocouples—and their number and locations in machines of different numbers of coils per slot. Dielectric tests were the subject of item three, reference being had to test voltages for machines of various ratings. The accords on this subject reached at previous meetings of the commission were amended in line with the French proposal as shown in Mr. Newbury's article. This agreement is the real achievement of the committee as it was the result of much discussion.

INSULATION CLASSIFIED

The fourth item of the report referred to the classifications of insulating materials in three divisions, roughly stated—class O being dry organic materials, class A impregnated organic materials, class B inorganic materials built up with a binder, and class C inorganic materials without a binder—and the permissions regarding temperature rises when these materials, singly or in combination, were used. The last item was concerned with the answer to the famous question, "Is there a demand for overload in your country and what is the extent of that demand?" which was the subject of five experts' papers from as many countries. The answer in the report was (1) "that there is no general demand for a sustained overload in the I. E. C. rating," and (2) "that the demand for momentary overload for various purposes should be regarded as a service condition." The report closed with a recommendation that the publication in book form of rules on rating should be deferred until the rules regarding larger machines are ready for promulgation. All of the items in this report were adopted.

The advisory committee on symbols made a few corrections in the previously published work of the commission on this subject, according to Colonel Edgcumbe, chairman of the committee. A certain number of symbols for traction diagrams were offered for publication, as were also the Greek letter ω (omega) as a symbol for the ohm and the fixation of the long thin lines and short thick lines in battery diagrams as positive and negative poles respectively. All of these recommendations were approved.

In the absence of Prof. W. F. Durand, chairman of the committee on prime movers, who had to return to his home in California, the report of this committee was offered by F. R. Low, editor of *Power*. The work of this group naturally divided itself into two parts, hydraulic and steam. These, however, were paralleled in the considerations of the committee in four sections, i.e., definitions, information required with order, method of test, and method of making measurements. The detailed reports on these four sections by the sub-committees on the two divisions were not presented to the plenary meeting, but they followed the form of the British proposals, which furnished the basis for discussion. As was natural, the work on prime movers excited wide interest, and the sessions of the committee were attended by delegates from fourteen countries, those most active being Great Britain, France, Italy, Czechoslovakia and the United States.

Clayton H. Sharp presented the report of the committee on standardization of lamp caps and holders as set forth in a letter to the central office of the commission from Mr. Holst, chairman, summarizing the work of the technical committee at Geneva in March this year. "Although lamp-cap standardization has been the subject of a great deal of investigation and discussion during the last year by the technical committee, complete agreement has not yet been reached either for Swan or Edison cap dimensions," the committee said. "Only minor dimensions, however, remain still to be tentatively fixed in the case of the Swan caps. Because, unfortunately, the European manufacturers do not feel able to work within manufacturing limits as small as are used in America."

VOLTAGE STANDARDS FIXED

Standard low voltages as fixed by the advisory committee—for direct current at 110, 220, 440, 115, 230, 460; for single-phase alternating current at 110, 220, 115, 230; for three-phase at 110, 127, 220, 115, 133, 230 between phases and neutral—were presented by the chairman, Professor Lombardi. Nominal transmission voltages (mean values) at consumers' terminals were set at .1, 3, 6, 10, 15, 20, 30, 45, 60, 80, 100, 150, 200 and 300 kv., with maximum potentials at generator and transformer secondary terminals set in each case 10 per cent higher to compensate for line losses. Of these listed high voltages 6, 15, 30, 60, 100 and 200 kv. were indicated as preferred. Maximum and minimum voltage values and permissible variations under working conditions will be considered later.

The committee on traction motors had reached complete unanimity except on two points on which decision had been reserved by the French delegation, according to Mr. Roth, the chairman. The points in the report were: (1) Application of I.E.C. rules to all types of traction motors (French reservation). (2) Two classes of I.E.C. rating—one-hour and continuous. (3) Temperature rises (French reservation): Ambient temperature of 25 C. chosen as basis for comparable tables; temperature measurements by resistance method favored, but thermometer measurements permitted under certain conditions; temperature rises specified. (4) Conditions of excitation during test should correspond to rating of motor. (5) The voltage during test of ventilated motors should be the rated voltage for both continuous and one-hour rating tests; for totally inclosed motors the one-hour test should be used; rated voltage and continuous rating tests should use either three-quarter or one-

GROUP OF DELEGATES ASSEMBLED WITH THEIR WIVES AND DAUGHTERS AT WESTCHESTER-BILTMORE CLUB

half rated voltage as specified in the particular case.

This report was approved.

The committee on rules and regulations presented no conclusions on standardization of overhead lines as the commission had not been occupied with this subject long enough to acquire information on practices in different countries which would allow it to formulate such conclusions. The report was concerned entirely with the organization of procedure for correlating comparisons between the different countries and arranging for the study of these comparisons. This committee, under the able direction of Mr. Uytborck of Belgium, laid the foundation for a work of increasing importance. On account of the fact that the Belgian National Committee originated this work, the future direction of it was placed with the delegates of that country.

The plenary meeting took no adopting action on the report of the committee on insulating oils, because the conclusions of this group could not be circulated to the meeting. The report was read and its definite results regarding viscosity measurements and characteristic tests, according to Swedish, Swiss, German and American methods, were referred to the national committees for discussion. A part of the report was devoted to organization procedure. The chairman, Mr. Fulweiler, presented this report.

In regard to terminal markings, the only definite accomplishment referred to the markings of battery terminals, which were standardized as red, positive, and blue, negative. The reason for such apparently small achievement was the fact that the necessary agenda for other considerations had not arrived. The committee, under the direction of Dr. Strecker, continued its session to Thursday.

In closing the plenary meeting President Semenza said that all through the sessions of the advisory committees there had been manifested an admirable spirit of international amity, leading to the concessions from national practices which had been made by every country in the endeavor to arrive at a workable mean for all.

Notes on the Advisory Committee Meetings*

BY F. D. NEWBURY
Manager Power Engineering Department, Westinghouse Electric & Manufacturing Company

THE discussions of the International Electrotechnical Commission are becoming of more and more practical value with each successive meeting of its advisory committees. Those in touch with national standardization work in this country know that this work has its difficulties and delays. Add to these the additional difficulties of differing language and differing technical and commercial practices among a dozen nations and some conception of the great practical problems involved in international standardization will be gained. But, in spite of these difficulties, the work of the I.E.C. is making progress and each year brings more subjects into discussion and more agreements into the record.

It undoubtedly will prove of considerable value to the work of the United States National Committee of the I.E.C. to have had a meeting of the advisory committees in this country. Less than 10 per cent of the output of our electrical machinery makers is exported. European companies, on the other hand, build more for the export market than for their home markets. The chief engineer of one of the large English companies, for example, stated that 70 per cent of his company's product in large machinery is exported. Under these conditions it is easy to understand the lack of interest in international standardization among American engineers as compared with that of Europeans. These meetings have served to bring the subject of international standardization prominently before our engineers. They have widened the acquaintance of American engineers among their fellow workers in foreign countries, and, after all, effective cooperation depends on these personal contacts. When a small delegation from the United States has attended the advisory committee meetings held in Europe, it has been very difficult for them to interest their colleagues who remained at home in carrying out undertakings that were entered into. Now this very important part of the work of the national committee should be much easier.

It is possible at this time to give only personal impressions of the discussions and only in regard to those matters with which the writer has had some experience. These notes, then, will cover only those parts of the program of the meetings that dealt with the general subject of rating and testing and must be considered strictly personal and unofficial.

RATING OF INDUSTRIAL MOTORS

The rating of industrial motors was discussed in a series of short papers presented by experts of different countries on the specific subject of the demand that exists for a time overload in the respective countries. Among the half dozen papers presented only one, that by C. Rodgers, secretary of the British Electrical and Allied Manufacturers' Association, advocated the inclusion of a time overload in the motor rating. Professor Feldmann, president of the Dutch Electrotechnical Committee, who very ably presided at the meetings of the rating advisory committee, pointed out that the real difficulty in the long discussion of this question has been the confusion between a test rating and testing conditions on the one hand and service conditions on the other hand. The function of the I.E.C. is to establish rules which will be the same for all countries where machines of the same characteristics are produced and sold, so that tenders which originate from any of these countries will be comparable with one another. To be comparable motors of different origin must have the same kind of rating and the same temperature rise and correspond in those other rating factors that determine size and cost. Consequently, I.E.C. rules, if they meet these fundamental requirements, must specify one kind of rating, one set of performance limits (as temperature rise) and one set of test conditions. The present I.E.C. rules meet these conditions in their specification of a single rating without overload and a 50 deg. temperature rise (by thermometer method), but this I.E.C. rating is not employed for general-purpose industrial motors in either Great Britain or the United States.

It was generally agreed that for the purposes of the I.E.C. rating no time or sustained overload need be included. This clarifies the situation to a considerable extent. It was further proposed, as a way out of the remaining difficulty, that in those countries that use a rating in domestic trade that differs from the I.E.C. rating both the domestic rating and the equivalent I.E.C. rating in horsepower or kilowatts be stated on the nameplate. By this means there would be procured the possibility of international comparison among motors having different domestic bases of rating and the object of the I.E.C. rating would be attained. The rather obvious disadvantages of this double-rating specification are the double rating guarantee imposed on the manufacturer and the fact that tenders are usually requested for standard sizes of motors such as 5 hp., 10 hp., etc. This plan, of course, would result in standard British and American motors having odd horsepower ratings when rated on the international basis. If this requirement for listing both the national and the I.E.C. rating on the rating plate need be carried out only on motors sold in competition with motors of foreign origin, this double rating specification becomes much less objectionable from the American standpoint.

TEMPERATURE RISE

The elementary distinctions of meaning between temperature rise, ambient temperature and temperature limits were discussed in an excellent paper by Professor Morelli of Turin. There is considerable confusion as to the principles involved in the relations of these quantities in standards, and Professor Morelli's clear explanation deserves wider publication. The points discussed can only be suggested by these conclusions:

1. *Temperature rise* affects the size of a machine and is an attribute of rating.

2. *Ambient temperature* is a condition affecting service. It is not an attribute of rating and affects rating standards only indirectly in that a high-standard ambient temperature operates to reduce the standard temperature rise.

3. *Total temperature* limits are to be determined by experience in the operation of machines and by other experience relating to the time-temperature characteristics of insulating materials. These limiting temperatures also only appear "behind the scenes" in rating standards.

4. In the formulation of standards of rating, ambient temperature and total temperature limits are used to arrive at standard temperature rises. and the

*These unofficial notes on the I.E.C. proceedings relative to machine ratings, kindly prepared by Mr. Newbury for the ELECTRICAL WORLD, embody the first technical account of the advisory committees' accomplishments to be made public.

rises are the only temperatures directly associated with the test rating.

These principles may appear abstract and uninteresting, but confusion as to their real significance and practical application is at the bottom of a great deal of the difficulty in the rating situation both at home and in international circles.

THERMAL AND TIME RATINGS

Dr. Kennelly presented a paper on the thermal capacity of machines as an element of rating. His conclusions were that time constants should be valuable now as subsidiary information in the operation of machines, but that, after further study by designing and operating engineers, they may be found sufficiently important and reliable to be promoted from his category of useful information to the category of rating constants. James Burke, who presented considerable additional test data, favored their use as a factor in rating without further delay. The chairman, Professor Feldmann, in summing up the discussion, agreed that for any particular motor it would be easy to find by test and calculation the law connecting any two arbitrarily chosen ratings, but from the particular case to the formulation of a simple general law applicable to rating standards was, he thought, a long road.

The subject of a time constant as an element of rating aroused considerable interest and discussion. Dr. Kloss of Germany also presented valuable data. A statement by the American delegation to the effect that the various national committees give further study to intermittent and short-time operation, in which connection additional information concerning machines such as the binary thermal time constant may be serviceable, was approved.

In regard to the rating of large machines the important subjects discussed were temperature rises, methods of installing embedded temperature detectors and dielectric tests. Two years ago, at the London meeting, it was proposed that the temperature rise for large machine rotors insulated with class B insulation (built-up mica or asbestos) should be 95 deg. C. measured by resistance. Last year at The Hague this proposal, after discussion, became 90 deg. rise by resistance for the rotors of steam-turbine-driven generators and 80 deg. rise by resistance for other types. At the Hague meeting the detector method of measuring temperatures of the stator winding was seriously considered for the first time and temperature rises of 80 deg. C. for two-coil-per-slot windings with class B insulation and 60 deg. C. with class A insulation were recommended to the national committees for consideration.

The embedded detector method of measuring temperatures, which is so generally used for large machines in the United States and to a considerable extent in England, has not been favored on the Continent until very recently. This difference in opinion and practice arises largely from a difference in the types of armature windings generally used. In the United States the two-layer or two-coil-side-per-slot winding is used almost exclusively; abroad the one-coil-side-per-slot winding is very generally used. The detector method is much better adapted to the two-coil-side-per-slot type, because with the detector placed between coils the detector approximates the copper temperature even though the detector is separated from the copper by the full thickness of the coil insulation. The reason for this is that the upper and lower coil sides in the same slot have approximately the same temperature, and consequently there is little heat flow along the path between them. With little heat flow there is little temperature drop, and a detector placed at any point in this path will approximate copper temperature. Extensive tests have shown this measurable temperature to be within 10 deg. or 15 deg. of the copper temperature in most cases, even with high-voltage windings.

With the one-coil-side-per-slot winding, on the other hand, there is no such favorable location that is accessible outside of the coil insulation, and the detector measures the temperature of the outside surface of the coil or, which is nearly equivalent, of the core slot surface. This surface temperature is frequently as much as 30 deg. or even 40 deg. lower than the true copper temperature. But in spite of this inherent disability of the detector method when applied to one-coil-per-slot windings it was agreed that it was preferable to the resistance method, and particularly in the case of high-speed generators coupled to turbines, with which the time of shutdown is so long. To provide for these greater differences between true copper temperature and measurable temperature, in the case of one-coil-per-slot windings, a lower rise was recommended and the permissible rise decreases as the voltage (and thickness of insulation) increases. Thus, where 80 deg. rise was recommended for two-coil-per-slot windings, 70 deg. rise was recommended for one-coil windings up to 7,000 volts, with a reduction of 1½ deg. for every 1,000 volts in excess of 7,000 volts. For example, a 13,000-volt winding would have a permissible rise of 61 deg.

TEMPERATURE RISES CONFIRMED

At the New York meeting these temperature rises were confirmed by the rating committee, and they will probably be officially adopted by the I.E.C. This result represents a considerable achievement because Germany was not represented at the Hague meeting and discussed these proposals for the first time at New York. The German delegation came to the meeting questioning the desirability of adopting the detector method (and particularly for one-coil-per-slot windings), but showed a commendable spirit of open-mindedness combined with a thorough knowledge of the situation based on extensive experimental investigations. The present German national rules include lower temperature-rise limits and specify the increase in resistance method of temperature determination instead of the embedded temperature detector method. The German delegation approved the proposed I.E.C. rules with the understanding that their own national rules were different but that they would use their best efforts to have them changed.

The advisory committee on rating supplemented this important work on temperature rises by adopting rules governing the installation of embedded temperature detectors for acceptance tests. These follow very closely the A.I.E.E. rules except that they do not cover as many details. On account of the importance of these regulations and their interest to American engineers the recommendations are quoted below:

Methods of Temperature Measurement by Embedded Temperature Detectors

Embedded temperature detectors are resistance detectors or thermocouples built into the machine during construction at points which are inaccessible when the machine is completed.

General.— At least six detectors shall be built into the machine, suitably distributed around the circumference and placed in positions along the length of the core at which the highest temperatures are likely to occur. Each detector shall be installed in intimate contact with the surface whose temperature is being measured and in such a manner that the detector is effectually protected from contact with cooling air.

Two Coil Sides per Slot.—When the winding has two coil sides per slot, each detector shall be located between the insulated coil sides within the slot.

More than Two Coil Sides per Slot.—When the winding has more than two coil sides per slot, each detector shall be located in a position between insulated coil sides at which the highest temperature is likely to occur.

One Coil Side per Slot.—When the winding has only one coil side per slot, each detector shall be located between the outside of the coil insulation and the inside of the slot lining at the bottom of the slot, except in the case where an air duct is adjacent to the bottom of the slot. In this last case the detector shall be placed between the outside of the coil insulation and the inside of the slot lining at the side of the slot, or the detector may be located between the laminations of the tooth, at the center of the tooth and midway between air ducts.

If desired by the manufacturer in the case of stators having one coil side per slot, the detector may be placed on the copper inside the coil insulation.

TEMPERATURE DETECTORS

There is one important difference in the rules covering the application of the embedded temperature detector method as recommended by the I. E. C. and as covered in the A.I.E.E. standards now in force in the United States. The I.E.C. has limited the use of this method to relatively large machines—5,000 kva. and larger in the case of steam-turbine-driven generators and 5,000 kva. and larger, or a core length of one meter or over, in the case of other types. The A.I.E.E. standards specify this method of measurement for steam-turbine generators larger than 750 kva. and for other types larger than 1,500 kva. While it would have been desirable from the standpoint of the United States delegates to have had the I.E.C. adopt the same limits of application as are in use in this country, it is very satisfactory to have this indorsement of the principle. With greater experience with the practical use of this method of measurement, the other national committees may possibly move of their own accord for its extension to smaller machines.

The action taken by the rating committee in regard to dielectric tests is important and is interesting as an illustration of the process by which international agreement is frequently reached. The general rule of the I.E.C. governing dielectric tests of small machines is the same as the general rule of the A.I.E.E.—i.e., twice rated voltage plus 1,000 volts. For several years the French committee has endeavored to secure action that would increase the

test voltage of steam turbo-generators to three times the rated voltage. This proposal was opposed by most of the national committees. Then the French modified their proposal and adopted for their own national standards the general rule (for windings of 6,000 volts and above) of twice rated voltage plus 3,000 volts. At the Hague meeting the Swedish committee proposed a rule that for machines of 10,000 kva. and larger resulted in a test voltage equal to twice rated voltage plus 5,000 volts. This Swedish proposal received some support —particularly from the French and Swiss—but was opposed by the British and the Americans. The existing German national rules required this same test of twice rated voltage plus 5,000 for machines having rated voltages of 5,000 and higher, so the Germans could be expected to support this higher test. At the New York meeting these several proposals, ranging from twice rated voltage plus 1,000 volts to twice rated voltage plus 5,000 volts, were discussed, but no agreement could be reached in the large advisory committee.

A smaller sub-committee was then appointed, consisting of one delegate from each of the nine countries represented on the rating advisory committee, and this sub-committee was able to agree, after a thorough discussion, on the modified French proposal of twice rated voltage plus 3,000 volts, with the additional provision that this higher test would apply only to machines of 10,000 kva. and larger. For machines smaller than 10,000 kva. the existing rule of twice rated voltage plus 1,000 volts applies. The complete recommendation covers a sliding scale of test voltages for machines of different rated voltages, as follows:

For Machines 10,000 Kva. and Larger

Rated Voltage	
Up to 2,000	$2E + 1{,}000$ volts
2,000 to 6,000	$2\frac{1}{2}E$
6,000 up	$2E + 3{,}000$ volts

TOLERANCES FOR GUARANTEES

For several years the advisory committee on rating has been considering the subject of tolerances to be applied to guarantees. In this country we have adopted tolerances for only two quantities—the speed of direct-current series and shunt motors and the impedance voltage of transformers. Abroad the commercial use of tolerances in connection with guarantees is quite general, and eight of the eleven countries that reported on this subject were ready to propose definite figures on a wide range of characteristics, such as efficiency, power factor, speed, slip, starting current, etc.

A tolerance in this connection is used in the same sense as tolerance in machine-shop practice. It is intended to cover the unavoidable difference between the intended value—the calculated value as a rule—and the tested value. These unavoidable differences cover such things as, for example, discrepancies in copper losses, caused by the allowed manufacturing tolerance in magnet-wire sizes, and other unintentional discrepancies in losses and reasonable errors in measurement.

In discussions of this subject there seems to be some tendency to consider the practice of giving guarantees without a tolerance to be on a higher ethical plane than the alternative practice—there is apparently some stigma attached to a tolerance. If the real nature of a tolerance is examined, it will be seen that the use of an officially standardized tolerance, known to both purchaser and maker, merely amounts to standardizing the so-called "margin" between calculated values and guaranteed values now used by makers in this country. Some "margin" or tolerance is necessary if guaranteed figures are given in good faith—no maker can guarantee calculated or even tested values—and justify his action ethically, assuming that these values represent the best performance the maker can expect to meet. To illustrate the equivalence of these two practices: a maker in this country may expect, as a result of calculations or tests on previously built machines, to meet 90 per cent efficiency. He may then reasonably guarantee 89 per cent without a tolerance. A European maker under the same conditions would guarantee 90 per cent efficiency with a tolerance of 10 per cent applied to the tested losses, resulting in the same minimum guaranteed figure.

This simple illustration shows why it is of considerable advantage to the American maker, quoting on motors for export in competition with English or German makers, for example, to subscribe to and make use of the tolerance in export business. Otherwise the American maker's efficiency of 89 per cent is very apt to be compared with the European competitor's figure of 90 per cent without any distinction being made between them.

At the New York I.E.C. meeting the American delegates felt it necessary, in view of the existing practice in this country, to oppose the principle involved in the general use of tolerances. It is hoped, however, that with a more general understanding of the nature and use of tolerances, as employed abroad, the United States National Committee of the I.E.C. will find it possible to indorse the principle and agree to the values now pretty well established in foreign practice. Fortunately this is not a situation that involves a change in motor size or construction; it merely requires a change in commercial practice. There can be one practice for domestic business (guarantees without tolerance) and another practice for export business, without the serious complications that would arise if the motor rating or construction were involved.

The question of method of measuring efficiency was discussed, and there was unanimous approval of the separate loss basis for making efficiency guarantees and checking them by test. An interesting side light on the relative accuracy of efficiency tests made by measurement of input and output and those made by measurement of the separate losses appeared in the British discussion of tolerances. They recommended a tolerance of 10 per cent of the sum of the declared losses in the case of guarantees made on the basis of the separate loss method, but for a guarantee by input-output test an additional tolerance of 0.5 per cent of the input was recommended. For efficiencies below 88 per cent a full percentage of the input plus 10 per cent of the losses was suggested. The whole subject of efficiency determination was referred to a small sub-committee of four, with representatives from Great Britain, France, Germany and the United States, to work out the details of the measurement or calculation of the various losses of the different types of machines.

WATER-COOLED TRANSFORMERS

That there still remain questions about which there is considerable difference of opinion was shown by the discussion of the limiting temperature rise allowed for water-cooled transformers. In the present I.E.C. rules the limiting temperature rise is 60 deg. C. The present A.I.E.E. standards permit only 55 deg. C., the same rise as is allowed for oil-immersed, self-cooled transformers. Discussion developed the situation as shown by the following table:

Source	Rise Recommended
I. E. C.	60 deg. C.
U. S. A. (same as A.I.E.E.)	55 deg. C.
Great Britain	65 deg. C.
Germany	70 deg. C.

These differences arise from the degree to which the difference between the 40-deg. air temperature (used as the basis for the allowed temperature rises of oil-immersed, self-cooled transformers) and the corresponding 25 deg. temperature (used as the basis for the allowed temperature rises of water-cooled transformers) is used to increase the temperature rise of the water-cooled transformer. In the United States practice no advantage is taken of this difference, while in the German practice full advantage is taken of it.

The German delegate suggested as a possible compromise that 70 deg. rise be permitted in water-cooled transformers provided with conservators (a device to maintain the transformer tank completely full of oil and so prevent the entrance of air and water vapor into the tank with the heating and cooling of the oil) and that the present I.E.C. limit of 60 deg. rise be retained for transformers without conservators. The United States delegate, in view of the very strong feeling in this country against higher transformer temperature rises, did not favor this compromise, and agreement on any new proposition was found to be impossible. The rating committee voted to retain the existing 60 deg. rise for water-cooled transformers and to submit to the national committees the question of authorizing a higher rise for transformers with conservators.

SPARK-GAP DIMENSIONS

An action that was particularly gratifying to the United States delegation was proposed by the British delegate and approved by the committee. The A.I.E.E. standards for spark-gap dimensions were approved for international standardization as these A.I.E.E. standards are now in use throughout the industrial world and have been checked by the researches of the British National Committee. Final action will be taken after this proposal has been submitted to the various national committees.

To conclude, definite formal action was taken by the rating committee on five important matters:

1. It was agreed that for the purpose

of the I.E.C. rating no sustained overload need be included.

2. Temperature-rise limits for large machines.

3. The definition and application of the embedded temperature detector method.

4. Dielectric test for large machines.

5. Definitions of the four classes of insulation (O-A-B-C).

This is an accomplishment of which the I.E.C. may well be proud.

Bureau to Inform Banks on Utility Bonds Is Set Up

A bureau to supply banks in all parts of the country with information on public utility bonds has been established in New York City. This bureau, the first of its kind, was organized by the National Association of Mutual Savings Banks and is known as the Research Bureau of Public Utilities. Its offices are at 11 East Thirty-sixth Street. Its formation resulted from action taken by the National Association of Mutual Savings Banks at its convention in Poland, Me., last June.

John Balch Blood, a former member of the Interstate Commerce Commission, is director and Milton W. Harrison, executive vice-president of the association, is associate director.

Among the public utility interests which helped organize the bureau were the Brooklyn Edison Company, North American Company, American Light & Traction Company, Associated Gas & Electric Company, Adirondack Power & Light Corporation, H. M. Byllesby & Company, Harris, Forbes & Company, Commonwealth Power Corporation, Dillon, Read & Company, Electric Bond & Share Company, Howe, Snow & Bertles, Public Service Stock & Bond Corporation, Stone & Webster, Inc., Utilities Securities Corporation of Chicago and the United Light & Power Company. While these interests have taken an important part in the formation of the bureau, it is intended that eventually the bureau will be supported entirely by memberships taken out by banks in all parts of the country.

Strong hope is expressed that the bill now before the New York State Senate which permits savings banks in that state to invest in certain public utility securities will pass that body and be approved by the Governor.

Government Loses Suit Over Control of Radio

The control which the Department of Commerce has assumed over the assignment of wave lengths to radio broadcasting stations was upset on April 16, so far as any compulsory acquiescence is concerned, by the decision of the United States District Court in Chicago in favor of the Zenith Radio Corporation, against which the government had brought a criminal action charging it with operating radio apparatus in its station (WJAZ) in a way that ignored the provisions of its license.

Station WJAZ was licensed to operate one night a week for two hours on the same wave length of 322.4 meters assigned to the General Electric Company Station KOA at Denver. Unable to obtain permission for more time, WJAZ "pirated" a wave length which was set aside for use of Canadian broadcasting stations. In addition to using the wave length the station also extended its time on the air.

The court found the wireless act of 1912—the only one in force—ambiguous and said: "There is no express grant of power in the act to the Secretary of Commerce to establish regulations. If there is a conflict between a provision in the license and the regulations established by Congress, the latter must control."

In comment Mr. Hoover said that if radio sending stations are to select their own radio lengths and their own time, effective public service will be at an end. Determination of the use of wave lengths requires discretionary or semi-judicial authority, Mr. Hoover said, and should be controlled by an independent commission as provided by the pending White bill. The administration of the decisions of the commission, together with the minimizing of interference and the furthering of the development of the art, are, he said, administrative functions and should be vested in one of the executive departments.

Hydro to Build Ottawa-Toronto Line

Ontario Commission Will Purchase About 250,000 Hp. from Gatineau Power Company and Transmit It at 220 Kv. to Tie in with Niagara System

AN AGREEMENT has been authorized by the Ontario government for the delivery by the Gatineau Power Company at the Quebec-Ontario boundary in the vicinity of Ottawa of from 230,000 hp. to 260,000 hp. of hydro-electric energy at a price of $15 per horsepower. Delivery will commence with a block of 80,000 hp. in 1928. Total delivery is to be completed in 1931. The contract binding the delivery is for 30 years, dated from 1928. The addition of this substantial block of power insures ample provision for Ontario's power requirements for the next five or six years and represents not only the most important achievement effected to date by the Hydro-Electric Power Commission under the chairmanship of C. A. Magrath, but one of the most striking advances in the whole history of power development in Canada.

The Gatineau Power Company, from which the new block of power has been secured, is a subsidiary of the International Paper Company, which is at the present time constructing power plants on the Gatineau River at Chelsea and Farmer's Rapids, near Ottawa, from which developments certain amounts of power will be delivered under this new contract. The Gatineau Power Company also contemplates a big development at Paugan Falls, a few miles further up the Gatineau River, which will probably add 150,000 hp. to the total output. These plants were alluded to in last week's ELECTRICAL WORLD (page 829), on which a map showing the Ottawa and Gatineau Rivers will be found.

The power to be delivered to the Hydro commission will be at a maximum voltage of 220,000, which is the highest for which electrical equipment is manufactured at the present time. This power will be transmitted from a point near Ottawa to connect with the Niagara system near Toronto. The transmission lines will be approximately 230 miles in length and will require an expenditure of from $10,000,000 to $15,000,000. Construction of these lines will be begun immediately. According to Premier Ferguson, the estimated cost of the power delivered to the Niagara system at Toronto will be from $7.50 to $8 per horsepower less than the cost of producing a similar quantity of power, at the maximum load factor provided for, from steam plants at present prices for coal and equipment.

The Hydro-Electric Power Commission also has under consideration the development at the Chats Falls, on the Ottawa River, in the near future, of extra power to meet the demands of the municipalities, pending the completion of the projected St. Lawrence development. The making available of 230,000 hp. to 260,000 hp., along with the proposed development at Chats Falls, will, according to Premier Ferguson, assure the people and the industries of Ontario of an adequate supply of power. Though the cost of the Gatineau power to the commission will be only $15 per horsepower, the expense of transmitting it to Toronto will bring the cost up to that of the Niagara product, it is said, and no reduction in rates is likely.

Denver Has to Pay for Services of State Commission

Valuation of the property of the Public Service Company of Colorado in Denver by representatives of the city under the direction of H. B. Dwight, engineer of the Colorado Public Utilities Commission, is actively under way. Following a visit from Raymond Palmer of New York, who has been named by the city to serve in a consultant capacity, a plan of procedure has been established, and it is hoped that the properties will be checked within 90 days at least, for the purpose of establishing valuation and rates for the new franchise now being sought by the company. Inasmuch as the present franchise expires May 15, it will be impossible to submit the measure for a vote of the people before its expiration, and consequently an ordinance is now being prepared by which present rates and relationships are to be continued indefinitely and until the new franchise is denied or approved.

Under its charter, Denver is compelled to pay for the services of the state commission, which are available without charge in any Colorado city not having home rule.

Purchases and Mergers

Maine, Oklahoma, Illinois and Other States Represented—Coming Consolidation in North Ontario

PURCHASE of the Western Maine Power Company, Limerick, with a hydro-electric plant on the Little Ossipee River, by the New England Public Service Company has been announced. The Western Maine serves several adjacent counties in New Hampshire in addition to parts of York, Oxford and Cumberland Counties in Maine, and its charter rights allow it to export hydro-electric energy from Maine. The Central Maine Power Company, the largest Insull property in the Pine Tree State, will be interconnected with the Western company by a 33-kv. tie line soon to be built.

Sale of the 110 miles of transmission line of the Inland Utilities Company, in Oklahoma, to the Southwestern Light & Power Company adds fifteen towns to the Southwestern company's system and gives it a total of 325 miles of high-tension lines. The Inland Utilities Company started operation at Elk City and Hobart two years ago. The merger is expected to bring an interconnected electric transmission system for western Oklahoma. The Southwestern Light & Power Company is a subsidiary of the Middle West Utilities Company of Chicago.

The Central Illinois Public Service Company has received permission from the Illinois Commerce Commission to purchase the municipal electric power plant at Brookport, Ill., and the property of the Cambria (Ill.) Light, Heat & Power Company.

The Woodland Light & Power Company, supplying service to Herman, Hubbart and Rubicon, Wis., has been made a part of the Wisconsin Gas & Electric Company's system.

Citizens of Blanchardville, Wis., have voted, 113 to 110, in favor of selling their electric plant to the Wisconsin Power & Light Company. The proposition was voted down by an overwhelming majority last spring.

The Interstate Public Service Company of Indianapolis has purchased the municipal plant at Loogootee, Ind., and will connect that place with its Edwardsport-Petersburg line.

Application has been made to the Public Service Commission by the New York State Gas & Electric Corporation for consent to the purchase of the electric distribution systems of the Delancey Electric Light Company and of Malcolm E. Hotchkin of Andes. It is not proposed to acquire the generating stations of either plant. Both operate in Delaware County.

The Georgia Railway & Power Company has purchased the system of the Demorest (Ga.) Light & Power Company, which has been consolidated into the Cornelia district of the power company.

Elsberry, Mo., has voted by 320 to 106 to sell its plant to the Missouri Edison Company of Louisiana, Mo.

The electric light and telephone systems of the town of Timmins, Ontario, have been sold by the Northern Ontario Light & Power Company to the Canada Northern Power Corporation. The two systems will be operated by the Porcupine Telephone & Power Company, whose entire capital stock will be owned by the Canada Northern Power. The deal gives the Canada Northern the control of all the lighting and power business in Porcupine and its vicinity.

Another big northern Ontario power deal is now taking shape in the proposed acquisition by Nesbitt, Thomson & Company, Ltd., of the Northern Ontario Light & Power Company. When the deal is consummated the Nesbitt-Thomson interests, through the Power Corporation of Canada, will be operating separate companies in each of the principal mining camps in the north country. The Northern Canada Power Company is supplying power and light to the Porcupine and Gowganda districts, and the Northern Ontario Light & Power Company is supplying power and light to the Cobalt, Kirkland Lake and South Lorrain mining camps. The latter company is controlled by Irvin Bonbright and associates; F. O. Blackwell, of the New York engineering firm of Vielé, Blackwell & Buck, who have been the pioneers in the power field of northern Ontario, and the Fasken interests of Canada.

Stream Survey Would Cost $7,322,400

Work Would Take Time, and the Chief of Engineers and Federal Power Executive Think Its Importance Warrants Making an Early Start

IT WILL cost $7,322,400 to make general examinations of all streams where power development appears feasible. A report supporting that conclusion has just been sent to Congress by the Chief of Engineers and the executive secretary of the Federal Power Commission. The river and harbor act of 1925 made provision for this estimate of cost as an outgrowth of agitation for legislation to devote license fees collected under the water-power act to general surveys sufficiently accurate to allow of comprehensive plans of water utilization.

It is pointed out in the report, however, that it is not necessary or desirable to provide at once for a comprehensive program of surveys, though the importance of the work and the length of time required to complete it are such that it should be inaugurated as soon as practicable. Data of the character proposed, it is stated, would be of particular value in reaching correct decisions as to the best plan for the comprehensive development of the power resources of streams. The report suggests that attention be given first to streams on which there is a possibility of the federal government's undertaking, either alone or in connection with private interests, construction work for the improvement of the stream.

The detailed items of the estimate are contained in the tabulation printed below.

Streams draining to Atlantic Ocean north of Cape Cod: St. Croix, Machias, Union, Penobscot, Kennebec, Androscoggin, Presumpscot, Saco, Kennebunk, Salmon Falls and Merrimac..	$147,000
Streams draining to Atlantic Ocean between Cape Cod and New York Harbor: Taunton, Pawtucket, Pawcatuck, Thames, Connecticut, Housatonic.....	34,200
Hudson River and tributaries: Mohawk, Hoosac, Batten Kill, Wappinger Creek, Wallkill, Kinderhook Creek	106,500
Streams draining to Lake Champlain and Richelieu Rivers: Poultney, Otter Creek, Bequet, Ausable, Saranac, Big Chazy, Winooski, Hameille and Missisquoi	54,000
Raritan River	19,400
Delaware River and tributaries: Shehala Creek, Mongaup River, Neversink, Lehigh, Tohickon Creek, Meshaminy Creek, Perkiomen Creek.....	158,000
Rivers draining into Chesapeake Bay: Susquehanna, Panunkey, Rappahannock, Occoquan Creek, Patuxent, Potomac and James	531,200
Streams draining to Atlantic Ocean south of Chesapeake Bay: Roanoke, Meherrin, Neuse, Tar, Cape Fear, Yadkin, Peedee, Santee, Savannah, Altamaha, Satilla and St. Mary's.	826,600
Streams, except the Mississippi, draining to Gulf of Mexico: Suwanee, Withlacoochee, Apalachicola and tributaries; Mobile River System, including the Coosa, Black Warrior and Tombigbee Rivers; Guadalupe, Calcasieu, Amite, Tickfaw, Tangipahoa Chefuncte, Bayou Nezpique, Bayou Teche.....	909,000
Mississippi River and minor tributaries: Ouachita, St. Francis, Maramec, Illinois, Des Moines, Iowa, Wisconsin, Chippewa and St. Croix	467,000
Arkansas River and tributaries: White, Grand, Illinois, Petit Jean, Fourche la Fave and Poteau	$87,100
Ohio River and minor tributaries: Tradewater, Wabash, Green and Barron, Salt, Kentucky, Miami, Licking, Guyandot, Big Sandy, Muskingum, Little Kanawha, Beaver, Monongahela, Allegheny	393,100
Tennessee River	300,000
Cumberland River	250,000
Kanawha River	225,000
Missouri River and tributaries: Madison, Jefferson, Galatin, Marias, Musselshell, Milk, Yellowstone, Little Missouri, Cannonball, Grand, Moreau, Cheyenne, Bad, White, Niabrara, James, Big Sioux, Little Sioux, Platte and Kansas, Osage and Gasconade	425,000
Streams draining into Lake of the Woods and Hudson Bay drainage basin: Rainy, Big Fork, Little Fork, Vermilion, Kaweshiwi	250,400
Streams draining into Lake Superior: Pigeon, Brule, Devil Track, Cascade, Poplar, Temperance, Minitou, Baptism, Beaver Bay, Gooseberry, St. Louis, Ammicon, Brule, Bad, Montreal, Sturgeon and Carp	82,600
Streams draining into Lake Michigan: Wolf, Oconto, Peshtigo, Menominee, Manistique, Manistee, Muskegon, Grand, Kalamazoo and St. Joseph.....	512,100
Streams emptying into Pacific Ocean south of Columbia River: Bel, Mad, Klamath, Sacramento, San Joaquin, Kern	420,000
Columbia River and minor tributaries: Cowlitz, Lewis, Willamette, John Day	734,100
Snake River and tributaries.....	215,000
Streams draining into Pacific Ocean north of Columbia River: Skagit, Snohomish, Stilaguamish, Puyallup, Chehalis	104,100
Rivers in Hawaiian Islands.....	71,000

A.I.E.E. Regional Meetings

Everything in Readiness for Madison Gathering on May 6 and 7—Niagara Falls Program

TWO regional meetings of the American Institute of Electrical Engineers are to be held next month—the first at Madison, Wis., on May 6 and 7, with headquarters at the Hotel Loraine, and the second at Niagara Falls, N. Y., on May 26-28, with headquarters at the Niagara Hotel.

The program of the Madison meeting was printed in the ELECTRICAL WORLD for March 6, page 525, the only change in the technical proceedings being the addition of Dean Milo S. Ketchum of the University of Illinois to the educational authorities who will discuss cooperation in research between the colleges and the industries. This feature of the program is scheduled for Friday afternoon, the papers on high-tension cables being fixed for Friday morning and those on rural electrification for Thursday morning. The rural electrification papers, by Grover C. Neff and George G. Post, will be discussed by Prof. R. A. Stewart of the University of Minnesota, Eugene Holcomb of the Consumers Power Company, Commissioner C. B. Hayden of Wisconsin, Prof. R. A. Duffee of the University of Wisconsin and Prof. E. H. Lehman of the University of Illinois. Thursday afternoon will be given up to inspection trips and golf. In the evening President Glenn Frank of the University of Wisconsin will address the regional dinner. Further inspection trips will take place on Saturday morning.

For the Niagara Falls meeting attractive entertainment has been planned, including a steamboat trip on Lake Ontario Wednesday evening, a trip down the Niagara Gorge on Thursday afternoon, a special illumination of the Falls on Thursday evening, and an illustrated lecture on the Niagara power development on Friday evening. The convention dinner will be held on Thursday evening. The tentative technical program is as follows:

WEDNESDAY, MAY 26

Morning and Afternoon.—Symposium on Dielectrics and Power-Factor Measurements: "The Power Factor of Dielectrics and Insulation," J. B. Whitehead, Johns Hopkins University; "The Mechanism of Breakdown of Dielectrics," P. L. Hoover, Harvard University; "Standards for Measuring Power Factor of Dielectrics," H. L. Curtis, Electrical Testing Laboratories; "The Significance of Errors in Dielectric-Loss Measurements," C. F. Hanson, Habirshaw Electric Cable Company; "Use of Dynamometer Wattmeter for Measuring Dielectric Power Loss," E. S. Lee, General Electric Company; "Commercial Dielectric-Loss Measurements," R. E. Marbury, Westinghouse Electric & Manufacturing Company; "Three Methods of Measuring Dielectric Power Loss and Power Factor," C. D. Doyle and E. H. Salter, Electrical Testing Laboratories; "Compensation for Errors of the Quadrant Electrometer," D. M. Simons, Standard Underground Cable Company; "The Dielectric-Loss-Measurement Problem," B. W. St. Clair, General Electric Company; "Zero Method of Measuring Power with a Quadrant Electrometer," W. B. Kouwenhoven and P. L. Betz, Johns Hopkins University.

THURSDAY, MAY 27

Morning.—"Rectifiers and Their Auxiliary Devices," O. K. Marti, Cornell University; "Rectifier Voltage Control," D. C. Prince, General Electric Company; "Radio-Wave Propagation," E. F. W. Alexanderson, General Electric Company; "Circulation of Harmonics in Transformer Circuits," T. C. Lennox, General Electric Company; "A Flux Voltmeter for Magnetic Tests," G. Camilli, General Electric Company.

FRIDAY, MAY 28

Morning.—"Variable Armature Leakage Reactance," V. Karapetoff, Cornell University; "Fire Protection for Alternating-Current Generators," J. A. Johnson, Niagara Falls Power Company, and E. J. Burnham, General Electric Company; "Automatic and Supervisory Control of Hydro-Electric Generating Stations," F. V. Smith, Westinghouse Electric & Manufacturing Company; "Tests on Niagara Falls Hydro-Electric Units," J. A. Johnson, Niagara Falls Power Company; "Speed Measurements of Rotating Machines," P. A. Borden, F. K. Dalton and H. S. Baker, all of the Hydro-Electric Power Commission of Ontario.

Afternoon.—Power Transmission: "Interconnection and Superpower," S. Q. Hayes, Westinghouse Electric & Manufacturing Company; "European Transmission Practices," G. F. Chellis, Whitehall Securities Corporation; "Lightning and Other Experience on 132-Kv. Transmission Lines," M. L. Sindeband and P. S. Sporn, American Gas & Electric Company; "Notes on the Vibration of Transmission-Line Conductors," Theodore Varney, Aluminum Company of America; "Transmission-Line Sag Calculations," H. B. Dwight, Massachusetts Institute of Technology.

Nebraska City Passes Drastic Radio Interference Law

A recent occurrence in Grand Island, Neb., indicates the drastic extreme to which some city councils are likely to go in attempting to prevent radio interference, when complaint is made by even a few irritated listeners to broadcast radio programs. Just three such persons, alleging that their trouble was due to the Central Power Company's transmission lines, were able to convince the Mayor of Grand Island, and he the City Council, that an ordinance should be passed compelling the company to remove all of its 33,000-volt lines from the city within 90 days. Because of enlightenment of the City Council by a fair-minded broadcast listeners' league, which made a careful study of the situation, it is expected that the ordinance will be repealed.

Recent Construction by Portland's Electric Companies

Connecting its principal steam plant with its main receiving station for hydro power in the city of Portland, and supplementing the low-tension ties already existing, the Northwestern Electric Company has recently completed a 66,000-volt tie line through the city. The line, approximately 5 miles in length, runs from the Albina substation on the east side through residential and business districts to a point on the Williamette River opposite the lower end of Ross Island, where it crosses the river on two long spans, thence doubling back on the west side to the Lincoln Street steam plant. The river crossing is supported by three steel towers, a dead-end tower on each shore and a supporting tower on Ross Island near the center of the crossing. The east strain tower is 107 ft. high and the other two 175 ft. The east span is 1,052 ft. and the west span 1,133 ft. long. The line, exclusive of switching and transformation equipment, cost about $155,000.

A 3,000-kw. automatic indoor substation has been commenced by this company, at East Thirty-second and Weidler Streets. This location is a residential district and the building is designed to harmonize with its surroundings. It will be faced with red brick and trimmed in gray stone, and the grounds around it will be elaborately landscaped. Former substations of this class have been outdoor type.

With the completion of an 11,000-volt line approximately 8 miles long from Scappoose to St. Helen's, Ore., the Portland Electric Power Company recently began to serve St. Helen's from Portland. The line is constructed for operation at 66,000 volts, but for the time being will be operated at 11,000.

Two Units in Place at Bartlett's Ferry

THE Bartlett's Ferry development of the Columbus Electric & Power Company, on the Chattahoochee River, is about 19 miles above Columbus, Ga., and went into operation Jan. 24, while still under construction by Stone & Webster, Inc., managers of the property, who also designed the installation. Two 22,000-hp. vertical units are now in place, with space for two more of the same size.

The dam is about 2,000 ft. long and 145 ft. high, the operating head for maximum efficiency being 112 ft. Over half the capacity of the plant is now under contract, and the net earnings from this new business alone and savings effected from the operation of the new station will exceed the charges on all securities issued in connection with its construction. The plant is tied into the neighboring power systems of Alabama and central Georgia by 110-kv. interconnections.

Public Service Department

Bill Signed by Governor Sets Up New Body to Function as New York Public Service Commission

GOVERNOR SMITH of New York has signed as Chapter 350 of the Laws of 1926 the bill introduced by the Hughes committee on reorganization of state departments providing for a Department of Public Service. Of this new body the chairman of the existing Public Service Commission will be the first head. The department will have two divisions—a state division and a metropolitan division. The state division will perform the work of the present Public Service Commission. It will consist of five commissioners appointed by the Governor and approved by the Senate, who will serve ten years each. One of these will be designated by the Governor as chairman. The present commissioners will serve until their terms shall have expired and their successors shall have been designated and have qualified.

The metropolitan division will consist of three members who will be appointed by the Governor with the approval of the Senate for terms of nine years each, the chairman to be designated by the Governor. Each commissioner shall be a resident of a city of more than a million population, the membership being thus confined to Greater New York. This body will perform the work of the present Transit Commission. All the commissioners will receive an annual salary of $15,000 each, and any of them may be removed by the Governor after trial as prescribed in the act, instead of by a two-thirds vote of the Legislature, as now. The act will take effect on Jan. 1, 1927.

The Governor has also approved as Chapter 351 of the Laws of 1926 the bill increasing the term of transit commissioners from five to nine years, one to be appointed each three years. The Governor sent to the Senate nominations of John F. Gilchrist, president of the State Tax Commission; Leon D. Godley, former Assistant Police Commissioner of the city of New York, and former State Senator Charles C. Lockwood to serve for nine, six and three years respectively as members of the new Transit Commission. The nominations of Mr. Gilchrist and Mr. Lockwood were immediatetly confirmed, while that of Mr. Godley was referred to the finance committee in accordance with Senate rules. The new commissioners will succeed George McAneny, LeRoy T. Harkness and John F. O'Ryan, whose terms of office expired April 16.

New Power Company Formed in Northern Ohio

The Lake Erie Power & Light Company, with a capitalization exceeding $11,000,000, has recently been organized by interests identified with the Lake Shore Electric Railway Company of Cleveland to take over the light and power business of the latter company, which operates traction lines between Cleveland and Toledo. Properties of the Bellevue Illuminating & Power Company, Bellevue Light & Power Company and the People's Light & Power Company, which supply Bellevue, Castalia, Vermilion, Berlin Heights, Avon Lake, Avon and Bay village districts, have been acquired by the new company. Immediate construction is planned of a high-tension line feeding the Fremont and Woodville districts of northern Ohio, in which are a number of cement plants and limekilns. Further developments paralleling Lake Erie and reaching almost across Ohio are contemplated by the new interests.

Officers of the Lake Erie company are: Charles S. Thrasher, president; J. P. Harris, vice-president, and M. Ackerman, secretary and treasurer.

Maryland Utilities Association to Meet Next Week

A one-day meeting will be held by the Maryland Utilities Association on Friday, April 30, at the Southern Hotel, Baltimore. The electric group, under the chairmanship of Thomas W. Peters, general superintendent Potomac Edison Company, will have a round-table session in the morning, when A. R. Stevenson, Jr., of the General Electric Company will talk on electric refrigeration; Chief Engineer H. Carl Wolf of the Maryland Public Service Commission on "Rules and Regulations," and R. H. Tillman, new-business manager of the Consolidated Gas, Electric Light & Power Company of Baltimore, on illumination. In the afternoon Senator Floyd King of the Virginia Utilities Association and R. H. Haas of the Fitkin Utilities Association will address the convention, and L. G. Smith will report for the hydro-electric committee. Governor Ritchie, President Wagner of the Consolidated company and General Guy E. Tripp are to speak at the evening banquet.

Baltimore Rate Investigation Is Adjourned

With the conclusion of the cross-examination of President H. A. Wagner of the Consolidated Gas, Electric Light & Power Company of Baltimore on April 20, the rate hearing of the Maryland Public Service Commission was adjourned to afford counsel an opportunity to prepare briefs. Many witnesses have been heard, and contracts with the United Railways & Electric Company, cost of hydro-electricity from the Holtwood plant of the Pennsylvania Water & Power Company and comparison of Baltimore rates with those of cities further South were among the matters taken up.

A proposal by J. Wallace Bryan, counsel for the Industrial Power Consumers' Association, who is collaborating with the people's counsel in the endeavor to force a further reduction in rates to the amount of $1,300,000 a year, that the earnings of the company in the future be allowed on a basis of fixed charges plus dividends and an adequate amount to surplus was characterized as "impossible" by Mr. Wagner. Witnesses for the people conceded that the company's earnings are under the 8 per cent maximum on investment fixed by the commission in 1923, but thought 6¾ per cent enough.

Briefer News

Utica Gas & Electric to Have New Office Building.—A new six-story office building is to be erected by the Utica (N. Y.) Gas & Electric Company at the corner of Court and Genesee Streets to take the place of the leased premises now utilized. The new building, which will be up to date in every respect, will be occupied entirely by the company and is to be finished in March, 1927.

Ontario Legislators Think Chicago Diversion Robs Province of 500,000 Hp.—Prior to prorogation, members of the Ontario Legislature united without regard to party in approval of a resolution condemning the Chicago Canal water diversion. Premier Ferguson charged that Chicago was taking from Ontario the equal of 500,000 hp. and that this diversion would have acute effect in monetary and industrial loss.

Massachusetts May Promote Education of Electrical Apprentices.—A movement to establish a state school for the training of electricians is gaining headway in Massachusetts, where the Association of Electrical Workers has just gone on record in favor of it. Albert Edson, secretary of the State Board of Examiners, declaring that few first-class electricians are available in the state, is supporting the project strongly.

Engineering Lectures at Johns Hopkins.—On Wednesday, April 21, C. W. Hewlett, research engineer for the General Electric Company, lectured at the Johns Hopkins University School of Engineering on "Electronics." Next week, on April 28, C. F. Hirshfeld, chief of the research department, Detroit Edison Company, will discuss the question "How Long Shall We Live?" from the point of view of engineering and scientific development.

Hydro-Electricity Contemplated on Oklahoma-Arizona Boundary.—A low-head water-power plant on the Mountain Fork River in southeastern Oklahoma is under contemplation by Little Rock (Ark.) interests represented by R. J. Rhinehart. Such a plant, built on Beaver Bend, would, it is said, contain the possibility of generating 40,000 hp. for use in Oklahoma and southwestern Arkansas. A dam 150 ft. high, a 3-mile tunnel and a 14,000-acre reservoir form part of the scheme.

Work Progressing on Pacific Gas & Electric Melones Project.—Contracts will soon be let by the Pacific Gas & Electric Company for waterwheel and generator equipment for the 36,000-hp. Melones plant being built on the Stanislaus River in central California in co-operation with the Oakdale and South San Joaquin Irrigation District. The plant will contain two reaction turbines operating under a head of approximately 210 ft. and, together with a 4,500-ft. tunnel, will cost $2,500,000. The irrigation district is building a 200-ft. dam to impound 112,000 acre-ft. of water at a cost of $2,200,000. Water stored by the irrigation district

will pass through the power house and later be diverted for irrigation. The power company will pay the irrigation district for the water at a rate sufficient to pay the interest on the bonds and retire them in a period of 40 years. A crew of 150 men are now at work on the tunnel and power house, and it is expected to have the plant in operation by the spring of 1927.

"Superpower" for South Louisiana.—South Louisiana is to be enveloped by a "superpower" transmission system comparable to that being planned for Mississippi, according to Alves Dixon, manager of the Baton Rouge Electric Company, who in an address recently before Louisiana bankers told of the far-reaching plans of Stone & Webster affecting the Louisiana Electric Company. Interconnection by high-powered lines from Houston and Beaumont paralleling the Southern Pacific to Baton Rouge is the ultimate project.

West Penn Ready to Build Dam on Blackwater River.—Preparations are under way to begin the construction of the 90-ft. dam which the West Penn Power Company is to erect across the Blackwater River, 3 miles above Davis, W. Va. This dam, the first to follow the one recently built as part of the West Penn system for the West Virginia Power & Transmission Company across Cheat River at Cheat Haven, W. Va., will be one of a chain to be erected in tributaries of that stream to furnish hydro-electric energy.

Marconi Headquarters in London Turns on the Lights in American Dwelling.—When Captain P. P. Eckersley, chief engineer of the British Broadcasting Company, pressed a key at Marconi headquarters in London last week, a "model radio house" on Staten Island, in New York Harbor, was illuminated by electric light. This house, designed by Dr. Alfred N. Goldsmith, contains three receiving sets, with loud speakers in every room. A message sent from London and returned thither was also picked up in San Francisco and Honolulu.

Hell Gate Generates Billion Kilowatt-Hours in Twelve Months.—The total output of the Hell Gate generating station of the United Electric Light & Power Company, New York, for the twelve months ended on April 19 was 1,000,366,000 kw.-hr. Vice-President Frank W. Smith's confidence that this is the first time any steam generating station in the world has reached the billion mark in yearly production seems fully justified.

Interconnection in Wisconsin.—Electric systems in Wisconsin are already interconnected with one another at more than 200 points, according to a survey made by John N. Cadby, executive secretary of the Wisconsin Utilities Association. "About 7,000 miles of transmisssion lines tie together hydro plants with steam plants, city with city and company with company," said Mr. Cadby. "Five of these interconnections involve three companies connected at one point, each of which can furnish power to or receive it from the other. In 96 of the interconnections, where the companies concerned do not have their own operating stations, the tie-in means either that inefficient plants have been shut down or that the communities now receiving electric service would probably be without service if interconnections had not been established."

Rates Reduced in Oregon.—Affecting all the territory served by the Yamhill Electric Company, Newberg, Ore., with which the Tualatin Valley Electric Company is incorporated and which serves many small towns and rural communities in the Tualatin and Yamhill valleys near Portland, a voluntary reduction in rates was recently put into effect. The new rates provide average reductions in the following schedules: Commercial power, 3 per cent; rural power and light, more than 3 per cent; city residence light, nearly 12 per cent; commercial light, more than 14 per cent.

Ontario Hydro Appropriations Decrease.—The Ontario government estimates for the fiscal year 1927 provide for decreased expenditures on the Hydro-Electric Power Commission's system. Hydro expenditures in 1925 were $23,690,000; appropriations for 1926 are $15,520,000, and for next year they are estimated at $14,175,000. This includes the estimate of $3,000,000 for an eastern Ontario transmission line, as well as a new development at Port Severn and Musquash in the Muskoka system, to cost $200,000. An item of $1,000,000 is included for a 110,000-volt line in the St. Thomas district. As part of a general debt retirement plan, the Ontario government announced its intention to amend the Power Commission act so that the commission will pay its obligations to the province in cash instead of in bonds as at present. The Hydro has already paid over about $4,800,000 in bonds.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 2, page 80.]

Southeastern Water and Light Association—Hotel Casa Marina, Jacksonville Beach, Fla., April 27-29. W. F. Stieglitz, Columbia, S. C.

Southeastern Division, N. E. L. A.—Pinehurst, N. C., April 27-29. C. M. Kilian, 317 Hurt Bldg., Atlanta.

Nebraska Section, N. E. L. A.—Lincoln, April 29-30. H. M. Davis, Fraternity Bldg., Lincoln.

Maryland Public Utilities Association—Southern Hotel, Baltimore, April 30. W. E. Smith, 107 E. Redwood St., Baltimore.

Missouri Association of Public Utilities—Springfield, Mo., May 2-4. F. D. Beardslee, 315 North 12th St., St. Louis.

American Institute of Electrical Engineers—Regional meetings: Madison, Wis., May 6-7, and Niagara Falls, N. Y., May 26-28. F. L. Hutchinson, 33 West 39th St., New York.

National Fire Protection Association—Atlantic City, N. J., May 10-13. F. H. Wentworth, 40 Central St., Boston.

Electrical Manufacturers' Club—Hot Springs, Va., May 12-15. W. F. Field, Safety Cable Co., New York.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

National Electrical Credit Association—New York, May 20-21. F. P. Vose, 1008 Marquette Bldg., Chicago.

Electric Power Club—The Homestead, Hot Springs, Va., May 24-27. S. N. Clarkson, Keith Bldg., Cleveland.

Ohio Edison Pushes Plant on Mad River.—Construction work recently begun on a power plant for the Ohio Edison Company on Mad River, a few miles from Springfield, Ohio, is expected by company officials to be completed and the plant in operation by Aug. 1, 1927. C. I. Weaver, vice-president and general manager, says that construction will be pressed to take care of a constantly increased demand in Springfield, Urbana, West Liberty, Marysville and other places in mid-western Ohio. Reports that the Ohio Edison Company would be involved in a southern Ohio power merger in the near future were denied by Mr. Weaver.

Britten Metric Bill Unlikely to Be Reported.—In view of a decided disinclination on the part of the House committee on coinage, weights and measures to report out the Britten metric system bill, an alternate proposition has been brought forward in the form of a resolution providing that the Secretary of Commerce "initiate and execute plans whereby metric weights and measures may be brought into common use in commerce and merchandising." A sub-committee named to select from the vast amount of documentary material submitted that portion which could be printed as a part of the *Record* without making it too voluminous has finished its work.

Electric Power Club Program.—The proposed reorganization of electrical manufacturing associations and business policies are the principal subjects to be discussed at the annual meeting of the Electric Power Club at the Homestead, Hot Springs, Va., May 24 to 27. In addition to these subjects, which will be presented by committees of the club, L. A. Osborne, vice-president of the Westinghouse Electric & Manufacturing Company, will speak on the "Advantages of Co-operative Action in the Industry" and Hanford MacNider, Assistant Secretary of War, will speak on "Industry Mobilization."

New Bay Cable for Great Western Power Company.—Increased business in the San Francisco territory of the Great Western Power Company will necessitate the expenditure of $1,200,000 for added facilities during the next few months. Included in the program is the laying of the company's fifth cable across San Francisco Bay between a point near Richmond and Pier 39, a distance of 40,000 ft. The cable will be similar to one laid early in 1923, consisting of three 500,000-circ.mil conductors with shore ends of 750,000 circ. mil. Each conductor will have a rubber insulation of 12/32 in., and over the three spiraled conductors there will be an impregnated jute covering with armored wires on the outside. No lead will be used. The cable will have a

capacity of 10,000 kva. and will be installed at a cost of $332,000. Approximately $187,000 will be expended in building a 44-kv. steel-tower line from the San Francisco County line to Half Moon Bay, a distance of 22 miles. Two substations, each with a capacity of 1,500 kw., will be installed on this line.

Missouri Association of Public Utilities to Meet May 3.—Springfield, Mo., will be the meeting place of the Missouri Association of Public Utilities on May 3 to 5, and among the items on the program are an address by President S. D. Brooks of the Missouri State University and papers by Miss Mary McKelvey of the Empire District Electric Company, Joplin, on "Blazing the Trail"; by G. K. Miltenberger, Union Electric Light & Power Company, St. Louis, on "Taxes of Utilities," and by Chairman Lewis D. Gettle of the Wisconsin Railroad Commission on "Operation of the Inderterminate Permit in Wisconsin."

Santa Paula and Fullerton Districts of Southern California Edison Win Cups.—Marking the close of the second year of competition for the Charles A. Coffin Foundation cups between the 31 geographical districts composing the territorial divisions of the Southern California Edison Company, the Santa Paula district won the commercial cup for being the premier district in the commercial department for the year 1925, while the Fullerton district got the operating cup for being the leading district in the operating department. Vice-president R. H. Ballard publicly awarded the cups, response being made by C. B. Hutchinson for Fullerton and L. S. Lothridge for Santa Paula.

Three Companies Divide Small Territory in New York State.—The town of Schaghticoke, in Rensselaer County, N. Y., is not a densely populated community, but five proceedings have been pending before the Public Service Commission in a dispute over the territory. The commission has finally approved the exercise of a franchise by the Halfmoon Light, Heat & Power Company in a portion of the town, the sale of Warren A. Pine's line from Troy to the hamlet of Pleasantville to the Troy Gas Company and the exercise by the Troy company of a franchise in that vicinity. In addition service is being given in part of the town by the Adirondack Power & Light Corporation.

A.S.M.E. to Have Central-Station Power Session.—There will be a central-station power session on Wednesday morning, May 5, in connection with the meeting of the American Society of Mechanical Engineers at Providence. N. E. Funk, operating engineer for the Philadelphia Electric Company, will give a paper on comparative performance of air preheaters, and H. W. Leitch, general superintendent of power plants for the United Electric Light & Power Company, New York, will describe the tests on stoker-fired boilers in the Hell Gate station. Another paper on new boiler equipment at the Interborough Rapid Transit's Fifty-ninth Street plant, by H. B. Reynolds, J. M. Taggart and R. S. Lane, will be read by title.

Men of the Industry

F. W. Smith Heads Board of New York & Queens Utility

Frank W. Smith, vice-president and general manager of the United Electric Light & Power Company, New York, has been elected chairman of the board of directors of the New York & Queens Electric Light & Power Company. This honor, conferred on Mr. Smith during the past week, is one more entry in a record of steady advancement in the electrical industry covering a period of 46 years. Mr. Smith has grown up with the electric light and power industry from its very beginnings, and his career is intimately associated with the history of electrical development in New York City and vicinity.

His connection with the United Electric Light & Power Company began in 1880, when he entered the employ of what was then known as the United States Illuminating Company. Three years later he was promoted to be general clerk, and in 1889 he was made paymaster of the succeeding organization, the United Electric Light & Power Company. Subsequently he served as assistant auditor, assistant secretary, secretary, and in 1912 he was elected to the office of vice-president. It was not until 1916 that he assumed in addition the title of general manager, although he had long been the active managing executive of the company. Mr. Smith has been a prominent figure in the activities of the National Electric Light Association for a number of years, having served on the executive committee, as vice-president and in 1922-23 as president. He is at the present time chairman of the lamp committee.

F. W. SMITH

L. P. Hite, formerly of Henderson, Ky., has been appointed district manager of the Kentucky Utilities Company with headquarters at Morganfield.

E. B. McNaughton of the Strong & McNaughton Trust Company, Portland, Ore., and **W. H. Lines**, assistant to the president of the Portland Electric Power Company, were elected directors of that utility at the annual meeting of the stockholders. Mr. McNaughton succeeds W. M. Ladd, who had resigned on account of ill health, and Mr. Lines, having previously been appointed by the board to serve the unexpired term of the late F. I. Fuller, was officially confirmed in this appointment.

Paul A. Schoellkopf, president of the Niagara Falls Power Company, has returned to the United States aboard the White Star liner *Majestic*, arriving in New York April 20.

R. S. Pride, district manager of the Kentucky Utilities Company at Madisonville, Ky., has been placed in charge of the company's property at Earlington and Morton's Gap.

F. E. Smith, chief engineer of the Nebraska Power Company, has taken over the general supervision of the distribution department in addition to his duties in connection with the engineering department. Mr. Smith has been affiliated with the Omaha utility since 1906 and has been chief engineer since 1923.

Frank E. Cronan, commercial manager of the Richmond division of the Western States Gas & Electric Company, has been appointed Pacific Coast representative of the George W. Dunham Company of Utica, N. Y. Mr. Cronan will have charge of the sales on the Pacific Coast and on the Hawaiian Islands of an electrical washing machine manufactured by the Dunham company. He will maintain offices in San Francisco.

Alexander Speer, who has been connected with the New York office of the General Engineering & Management Corporation, has been assigned to the properties at South Boston, Va., as permanent manager. This was formerly the headquarters of the Southside Virginia Power Company, which recently was merged with other Virginia properties into the Virginia Public Service Company.

William Jorgensen has entered the steam-turbine division of the American Brown Boveri Electric Corporation. Mr. Jorgensen has had wide experience in both industrial power plants and central stations, a great part of which was gained in turbine installation for the General Electric Company. He later joined the Brooklyn Edison Company as a mechanical engineer in charge of new equipment, including turbines and feed-water heaters.

R. A. Lundquist of the electrical equipment division of the Department of Commerce, Washington, has been appointed export manager of the Electric Refrigeration Corporation, Detroit. He will assume his duties May 1. Mr. Lundquist is a graduate of the University of Minnesota and in 1905 began his professional career with the Missouri River Power Company at Helena, Mont., later spending some time with the Westinghouse Electric & Manufacturing Company at its East Pittsburgh plant. He opened an office in Minneapolis for general consulting work in 1916. He was appointed special agent

by the Department of Commerce to investigate the electrical goods market of Australia and the Orient, covering New Zealand, Australia, China, Japan, Korea and eastern Siberia. In August, 1921, he was appointed chief of the electrical equipment division of the Department of Commerce by Secretary Hoover, the position he has held to the present time. Of the eight years he has been chief of this division he has spent five abroad, and he is thoroughly familiar with the electrical specialty market in many foreign countries. Mr. Lundquist has contributed at various times the results of his foreign studies to the technical press.

John P. Voight, formerly connected with the electrical engineering department of Stone & Webster, Inc., is now district manager for the Railway & Industrial Engineering Company, with headquarters at Charlotte, N. C.

Louis Bruegl, who has been connected with the Lake Superior District Power Company's properties at Medford, Wis., has been selected to take charge of the company's recently acquired Rib Lake properties.

Hugh A. Smith, division engineer of the Idaho Power Company at Boise, has severed his connection with that utility to join the Longview (Wash.) Public Service Company.

Harry D. Makeever, who has been affiliated with the People's Light Company, Davenport, Iowa, for the past year, has been appointed sales manager of the People's Gas & Electric Company at Mason City, Iowa.

Albert W. Higgins, formerly president of the Southern Minnesota Gas & Electric Company and more recently vice-president of De Wolf & Company, Chicago utility bankers, has joined the staff of the General Engineering & Management Corporation as assistant to Ralph J. Ritchie, operating manager.

A. C. Fisher, who has been manager of the Point Pleasant district of the Jersey Central Power & Light Company, has retired from the public utility industry to engage in private business. He will be succeeded by T. D. Moore, formerly local manager at Toms River.

James A. Easley has been elected a vice-president of the Illinois Power Company to succeed E. J. Bechtel of New York, resigned. Mr. Bechtel's place on the board of directors has been filled by the election of **Robert C. Lamphier. H. A. Converse** has been elected to the directorate to fill the vacancy caused by the death of P. B. Warren.

Samuel E. Johnson, formerly superintendent of power distribution for the Chicago Suburban Power & Light Company, which was recently acquired by the Public Service Company of Northern Illinois, has been appointed district manager for the new territory and has established headquarters in West Chicago. Mr. Johnson has been in the utility business for nearly 30 years.

Melville B. Hall, treasurer of the Brown & Hall Supply Company, St. Louis, has disposed of his stock in that enterprise and has organized a new electrical and radio jobbing house to be known as Melville B. Hall, Inc. Mr. Hall is a director of the St. Louis Electrical Board of Trade and represents the electrical jobbers of that body. He was formerly an electrical engineer for the Wagner Electric Company in 1909 and 1910. He subsequently became sales engineer for the Westinghouse Electric & Manufacturing Company, remaining with that company until 1913, when he and Norman S. Brown, now president of the Brown & Hall Supply Company, organized an electric supply business known as Brown & Hall.

H. B. Flowers New President of Southwestern Division, N.E.L.A.

Herbert B. Flowers, who was elected president of the Southwestern Geographic Division of the National Electric Light Association at the convention held last week in Galveston, Tex., has been president of the New Orleans Public Service, Inc., the successor to the New Orleans Railway & Light Company, since the spring of 1923. Mr.

H. B. FLOWERS

Flowers affiliated himself with the New Orleans utility in that year after a period of service with the United Railways & Electric Company in Baltimore.

Following graduation from the law school of the University of Michigan in 1903 and from the engineering school of that university in 1905, Mr. Flowers entered the operating department of the Detroit United Railway. His first position with the United Railways & Electric Company was in the capacity of assistant superintendent of transportation. In 1917 he became assistant general manager and two years later general manager. Mr. Flowers' association activity has not been confined to the interests of the National Electric Light Association, but has included extensive committee work in the American Electric Railway Association.

V. P. McNamara has been named manager of the Puget Sound Power & Light Company's electric service at Ellensburg, Wash. Mr. McNamara was formerly connected with the company in Everett.

Z. T. Pettit of the Los Angeles Gas & Electric Corporation has been promoted to the position of underground electrical engineer, filling the vacancy caused by the death of O. C. Miller. Mr. Pettit entered the employ of the Los Angeles utility in 1905.

A. S. Phelps, formerly district manager of the Jersey Central Power & Light Company at Lakewood, has been transferred to the district office at Long Branch to succeed **Andrew J. Hoffman,** who will be assigned to a district in the territory of the Western United Gas & Electric Company. **A. B. Pettit** will succeed Mr. Phelps at Lakewood.

Lamar Aldridge, secretary of the Alabama Power Company, has recently been appointed treasurer to succeed R. M. MacLetchie, who has resigned to become comptroller of the Southeastern Power & Light Company. Mr. Aldridge.

C. L. Bacon has joined the engineering staff of the American Brown Boveri Electric Corporation in the steam-turbine division at Camden, N. J. Following graduation from the University of Nevada, Mr. Bacon occupied a position with the Consolidated Copper Company. He then took up steam-turbine work with the General Electric Company, being later transferred to the New York office of that company, where he engaged in sales work on turbines.

Obituary

Willard G. Carlton, superintendent of power of the New York Central lines, died of pneumonia April 15 in St. John's Hospital, Yonkers, N. Y. Mr. Carlton was born in Warren, Ill., and was graduated from Cornell University. Prior to affiliating himself with the railroad in 1905 he was connected with the engineering department of the Edison Electric Company in Chicago.

John W. Shartel, formerly president of the Oklahoma Utilities Association, died in Oklahoma City April 13 in his sixty-third year. Mr. Shartel was prominent in public utility circles in Oklahoma, devoting his attention especially to the electric railway industry. At the time of his death he was a receiver of the Oklahoma Railway Company and a director in the United States Chamber of Commerce.

Francis Hird, managing director of Siemens Brothers & Company, Ltd., Woolwich, and of the Siemens & English Electric Lamp Company, Ltd., died at Old Charlton, near London, England, March 25, in his fifty-ninth year. Mr. Hird, who was born of British parents in Paris in 1868, went to England in early childhood and studied under Prof. J. J. Thomson at the Cavendish Laboratory, taking his degree of B.A. at Cambridge in 1887 at the unusually early age of nineteen. In 1889 Mr. Hird joined the staff of Siemens Brothers & Company, Ltd., and after a few years became chief dynamo designer to that company. In due course, after having gained some commercial experience, he became head of the company's electric light and power department and for some time was works manager of Siemens Brothers Dynamo Works, Ltd., at Stafford, subsequently returning to Siemens Brothers & Company, Ltd., at Woolwich in order to take charge of their apparatus department and to develop their work in the manufacture of lighting equipment.

Recent Court Decisions

Desire to Save Others from a Danger Not Imminent Does Not Offset Contributory Negligence.—In Barnett vs. Des Moines Electric Company the plaintiff sued for damages because of injuries received in attempting to remove a broken electric light wire belonging to the plaintiff from the street near his home and wind it around a pole. He had relied for protection on a napkin with which he grasped the wire, but was badly burned. The United States Circuit Court of Appeals sustained a directed verdict for the defendant on the ground of contributory negligence. Barnett's plea that he was acting to safeguard children playing in the street 25 ft. or so away was not accepted in mitigation of his negligence since the children were not in imminent danger and he had plenty of time for reflection. (10 Fed. (2d) 111.)*

Definition of "Going Value"—In New York & Richmond Gas Company vs. Prendergast, the special master reporting to the United States Court for the Eastern District of New York had this to say on "going value": "Going value may, in my opinion, be defined as the difference between what a prospective purchaser would pay for a fully completed and equipped plant ready to operate, but which in fact had never operated, and one fully completed and equipped, which was actually operating, with an established business, as a going concern. The dominant and relevant fact in determining this element of value is not its original cost or the expense of acquisition, but rather the actual present value of the elements now owned and possessed, and the present replacement cost of these elements, if they were not already possessed, is an important factor in weighing their present worth." (10 Fed. (2d) 167.)

Company Not Obliged to Inspect Customer's Apparatus, but It Is Liable for Injuries Resulting from Defects of Which It Knows.—Deckard, administrator, sued the Bristol (Tenn.) Gas & Electric Company in the United States Circuit Court because of the death of a man employed by a brick company which received electric service from the utility over its own apparatus. The man lost his life while endeavoring to start a motor soon after a thunderstorm. The court affirmed judgment for the plaintiff, holding that though a company furnishing electricity was not generally charged with the duty of maintaining and inspecting a consumer's apparatus and was not responsible for injuries in the absence of negligence of its own, yet when the company had knowledge that an installation which it had installed and helped to repair was defective, it became liable for accident caused thereby. Evidence, the court said, warranted the submission of the case to the jury, and the latter's finding that electricity and not lightning caused the fatality was not a speculation, in view of certain testimony, while the questions of contributory negligence and violation of employer's orders were for the jury. A refusal to instruct the jury, that the defendant had no liability if it furnished no more energy than that contracted for, and the giving of an instruction that the question was merely whether defendant supplied the electricity contracted for under such circumstances that it should have anticipated trouble, were not misleading or grounds for reversal. (10 Fed. (2d) 66.)

Correction of Errors in Commission Orders Must Be Predicated on Existing, Not Past, Conditions.—Adjudicating a freight-rate dispute between the Illinois Commerce Commission and the Cleveland, Cincinnati, Chicago & St. Louis Railway, the Supreme Court of Illinois said that whatever errors may have been made in the past by the commission as a rate-making power may be remedied by a new order fixing the proper rate, but the order must be based on a consideration of what a reasonable rate would be under present conditions without regard to previous errors in former orders fixing rates. (150 N. E. 678.)

Supreme Court Overrules Illinois and New Jersey Commissions in Telephone Cases.—Two cases involving telephone rates have been decided by the United States Supreme Court, both in favor of complaining companies. In the case of the Illinois Bell Telephone Company vs. the Illinois Commerce Commission the court held that rates allowed by the commission for service at Peoria and vicinity were confiscatory and criticised the commission for delaying action on a petition of the company for increased rates. "It is proper to say," the court said, "that without explanation the commission's conduct evinces an entire lack of that acute appreciation of justice which should characterize a tribunal charged with the delicate and important duty of regulating the rates of a public utility with fairness to its patrons but with a quick hand to preserve it from confiscation. Property may be as effectively taken by long-continued delay in putting an end to confiscatory rates as by an express affirmation of them." Profits accumulated in the past cannot be used to sustain confiscatory rates in the future, the court held in affirming the United States District Court of New Jersey in the appeal of the Board of Public Utility Commissioners of that state against the New York Telephone Company. In this case the company had applied for higher exchange rates at various New Jersey cities. The commission ruled that the company had accumulated a depreciation reserve account in excess of requirements and that if it incurred a deficit in the future it should take funds from this reserve. "Customers pay for service, not for the property used to render it," said the Supreme Court in overthrowing the commission's contention. "Their payments are not contributions to depreciation or other operating expenses or to the capital of the company. By paying bills for service they do not acquire any interest, legal or equitable, in the property used for their convenience or in the funds of the company. Property paid for out of moneys received for service belongs to the company just as does that purchased out of proceeds of its bonds and stock. The property or money of the company represented by the credit balance in the reserve for depreciation cannot be used to make up the deficiency."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Wider Range of Evidence Permitted Before Commission than Before Court.—That broader rules govern the introduction of evidence in a commission proceeding than might be permitted in a judicial proceeding was indicated by the New York Public Service Commission *in re* Staten Island Rapid Transit Railway Company. The commission, although holding that it had no power to exempt any railroad from a statute requiring electrification, since its authority extended only to approval of plans, permitted the introduction of much testimony which it considered immaterial, indicating injurious consequences of electrification. The chairman said that in the very nature of a public service commission proceeding, and especially one where the public felt it had a right to express its views irrespective of the materiality of the evidence, wide latitude is permissible.

Exercise of Right of Eminent Domain Not Contingent on Value of Property.—In approving an application made by the Duquesne Light Company for permission to exercise the right of eminent domain in order to acquire a right-of-way for a transmission line to the plant of the Jones & Laughlin Steel Corporation and to supplement existing lines, the Pennsylvania Public Service Commission overruled vigorous objections from the owner of the property, who contended that the proposed construction was a private line for the exclusive use of the Jones & Laughlin Steel Corporation, that it was not necessary for the service of the public generally and that it was practicable to build a line across his property in another location with less damage to it. In addition to these objections, the protestant contended that the applicant could not exercise the power because no resolution of its board of directors had ever been passed authorizing the condemnation of his land. Further complaint was made that error was committed in excluding the protestant's offer to show the value of the land in question, its unique suitability for industrial purposes and the fact that the construction of towers and high-tension lines upon and over it would greatly and unnecessarily injure its value and lessen its marketability. The commission held that the first three objections were not substantiated, that a resolution of the directors was not necessary, and that approval should not be denied on account of injury to the remaining property since there was adequate provision for payment of all damages. It found no evidence that the company was acting wantonly or arbitrarily.

Financial and Corporate

Utility Market Quieter

Mixture of Moderate Gains and Losses Shown for Week as Trading Activity Dies Down

IN ALL of the major securities markets trading during the week under review lost much of its earlier feverishness and prices moved within a relatively narrow range. A continuation of easy money tended to improve the demand for gilt-edged utility bonds but did not have any pronounced effect upon the market in common stocks. Reports from the field nowadays indicate a high rate of business activity and earnings of most power companies are highly satisfactory.

In the quiet market of the week neither an upward nor a downward trend was established in the market for utility common stocks, and the average net change for the period was not more than two points. While the net changes represented both gains and losses, the latter were more numerous. Among the principal losers were United Light & Power class A stock, which fell four points during the week, and American Light & Traction, which fell approximately seven points early in the period but later recovered. Galveston-Houston preferred sagged off five points in the week. Two-point declines or thereabouts were recorded for such issues as American Public Service preferred, Arizona Power preferred, Engineers' Public Service, Portland Electric Power, Southern California Edison and Consolidated Gas, Electric Light & Power Company of Baltimore.

Among the issues that advanced were Tampa Electric, which rose five points; Kansas Gas & Electric preferred, and Columbus Electric & Power, which added five points to its position of the week before.

New Capital Issues

During the past week the Puget Sound Power & Light Company issued first and refunding mortgage 5 per cent gold bonds, series B, to the amount of $5,000,000 at 99½ and interest, yielding over 5.10 per cent. The Puget Sound company owns one of the most important power and light systems in the United States, furnishing nearly all the power and light (except that supplied by the municipalities of Seattle and Tacoma) in an area of more than 31,000 square miles in the State of Washington.

Another five-million-dollar offering was made by the Virginia Public Service Company in the form of twenty-year 6 per cent sinking-fund gold debentures, priced at 96½ and accrued interest, to yield about 6.30 per cent. The company, together with its subsidiary, the Newport News & Hampton Railway, Gas & Electric Company, serves with electric light and power 130 communities, with a total population of more than 220,000.

The Jersey Central Power & Light Company floated a million-dollar issue of first mortgage and refunding twenty-year 5½ per cent sinking-fund gold bonds, series A. These bonds were priced at 97½ and interest to yield over 5.70 per cent.

The Broad River Power Company floated an offering of first and refunding mortgage 5 per cent gold bonds, series A, amounting to $1,485,000. The Central Gas & Electric Company issued 21,000 shares of preferred stock without par value at $96 and accrued dividend per share.

February Customers' Sales $14,740,000.—Based upon monthly reports received by the ELECTRICAL WORLD from electric light and power companies selling stock direct to customers and employees, it is estimated that during February a total of 158,200 shares were sold in this manner. The total value of the stock sold, estimated at $14,740,000, was only one-half the sales reported for February of last year. A total of 24,450 customers participated in the sales during February.

Company Reports

Name of Company	Gross Earnings for February 1926	1925
Adirondack Power & Light*...	$742,197	$668,304
Alabama Power*.....	1,018,258	805,717
American Water Wks. & Elec.	3,769,952	3,427,121
Brazilian Trac., Lt. & Power	2,893,557	2,207,359
Detroit Edison*.....	†3,999,026	†3,330,060
Federal Light & Traction.....	565,263	525,400
Fort Worth Power & Light.....	241,675	238,491
Idaho Power.....	227,980	211,946
Kansas Gas & Electric.....	385,544	540,248
Massachusetts Ltg. Cos.*.....	308,306	278,512
Nebraska Power.....	379,793	367,514
Nevada-California Electric....	373,375	368,758
Pacific Power & Light.....	297,772	270,065
Texas Power & Light.....	631,568	593,674
West Penn Electric.....	2,914,948	.....

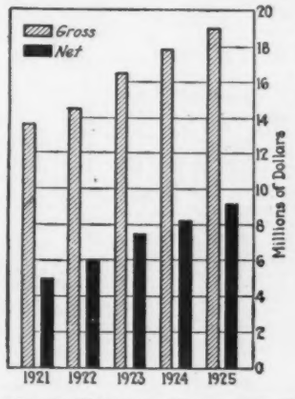
*March †Includes other revenues.

Associated Undertakes Unique Financing

In Largest Bond Flotation of Kind on Record Electric Company Introduces New Instrument for Financing Subsidiaries Through Holding Company

BY PAUL WILLARD GARRETT
Financial Editor *New York Evening Post*

ATTENTION already has been called to the sixty-five-million-dollar issue of Associated Electric Company convertible 5½ per cent bonds of 1946 because of the fact that the flotation was perhaps the largest piece of financing of its kind ever undertaken, but



ASSOCIATED ELECTRIC PROPERTIES SHOW CONSISTENT GROWTH IN EARNINGS

the instrument is equally worthy of note for certain features that distinguish it.

While the Associated Electric Company is a holding organization, the bond recently designed by J. I. Mange, president of Associated, and his bankers deserves higher rating than investors are likely to give if they place it in a category with many holding-company issues. In setting up a holding-company bond the makers have, in other words, gone far beyond the usual course in tightening the restrictions on subsidiary financing in a desire to strengthen the foundation for Associated Electric Company securities. What the bankers plan is, apparently, that funds needed by the various subsidiaries shall in general be raised hereafter through financing by the holding company (Associated Electric Company) and not by the operating companies directly.

The newly created Associated Electric Company is, of course, controlled by the Associated Gas & Electric Company and as such has jurisdiction over an important group of public utility properties in New York, Pennsylvania, Maine, New Hampshire, Connecticut, Kentucky, Tennessee, Indiana and the Philippine Islands.

Regarding the purpose of the new financing, J. I. Mange says: "The indenture under which the convertible bonds are to be issued is designed to provide a sound and permanent medium for major funded debt operations in financing the future development of the Associated Gas & Electric system and constitutes the first step in the simplification of the capital structure of this group of properties. The major portion of the proceeds of the present issue is to be used to retire various high-rate securities, effecting a substantial saving in the aggregate annual interest, dividend and sinking-fund charges."

In addition to the several restrictions imposed upon the Associated Electric

Company in the issuance of future bonds an important and almost unique provision is made that additional underlying bonds and preferred stock may not be issued to the public if the aggregate amount of such securities would thereby be increased to more than 50 per cent of the volume of bonds issued under the indenture of the Associated Electric Company.

Allis-Chalmers Issues Annual Report

In its annual report for the year 1925, just issued, the Allis-Chalmers Manufacturing Company reports net profit, after provision for federal income and all other taxes, of $3,417,368, as compared with $3,221,101, which was equivalent, after allowance for preferred dividends, to $8.78 per share on the common stock as compared with $8.01 on the common stock in 1924. Sales billed amounted to $28,921,357, against $27,855,524 during the previous year. Working capital as at Dec. 31, 1925, amounted to $26,283,364, compared with $24,915,160 the previous year. Unfilled orders at the close of 1925 were $10,147,073.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday April 17	Low 1926	High 1926
STOCKS			
ABITIBI PWR. & PAPER, com. —no par	74¼	71¼	84¼
Adirondack Pwr. & Lt.—7% pf.	k101	....	....
Adirondack Pwr. & Lt.—8% pf.	107	108	110
Adirondack Pwr. & Lt., com.—50	m 75	n 31	n 98
Ala. Pwr., pf.	k103	....	....
Allis-Chalmers Mfg. pf.	106	105	110
Allis-Chalmers Mfg., com.	k 82¼	78¼	94¼
Aluminum Co. of Amer., com.	k 93	....	....
Aluminum Co. of Amer. new, pf.	k 93	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m108	108	131
Amer. & Foreign Pwr., 7% pf.—no par	k 90	89	98
Amer. & Foreign Pwr., com.—no par	k 18¼	17	42¼
Amer. Bosch Magneto, com—no par	k 20	19¼	34¼
Amer. Brown Boveri, Elec.	k 34¼	30¼	48¼
Amer. Brown Boveri Elec. pf.	k 93	86	97¼
Amer. Elec. pwr., pf.	c111	101¼	111¼
Amer. Gas & Elec., 6% pf.—no par.	k 90¼	90¼	95¼
Amer. Gas & Elec., com.—no par.	k 72¼	64	99¼
Amer. Lt. & Trac., 6% pf.	105	114¼	115¼
Amer. Lt. & Trac., com.	k204	195	263
Amer. Pwr. & Lt., 6% pf.	k 93	....	....
Amer. Pwr. & Lt., com.—no par.	k 52¼	48¼	79¼
Amer. Pub. Serv., 7% pf.	k 95	....	....
Amer. Pub. Serv., com.	47	45	80
Amer. Pub. Utilities, 4% pf.	k 86	....	....
Amer. Pub. Utilities, 6% pf.	k 86	....	....
Amer. Pub. Utilities, 7% pf.	m 90	....	....
Amer. Pub. Utilities, com.	70	80	82
Amer. States Sec., A	k 2¼	....	....
Amer. States Sec. B	k 1	....	....
Amer. Superpwr., pf.—25	25	23	26¼
Amer. Superpower, pf.	89	90	94
Amer. Superpwr., Class A—no par.	k 22	19¼	37¼
Amer. Superpwr., Class B—no par.	k 23¼	21¼	39
Amer. Wtr. Wks. & Elec., 7% pf.	105	101¼	108¼
Amer. Wtr. Wks. & Elec., com.—20.	k 49¼	43¼	74
Anaconda Copper	k 43	41¼	51
Appalachian Pwr., 7% pf.	100	99	101
Appalachian Pwr., 1st pf., 7%	100	99	101
Appalachian Pwr., com.	80	80	83
Arizona Pwr., 7% pf.	k 74	....	....
Arizona Pwr., com.	m 27	27	35¼
Arkansas Cent. Pwr., pf., $7—no par	102	99	102
Arkansas Lt. & Pwr., 7% pf.	k 95	....	....
Arkansas Lt. & Pwr., com.	100	110	115
Asheville Pwr. & Lt., 7% pf.	l102	100¼	104
Assoc. G.&E., pf.—$3 50—50	k 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	k 82¼	....	....
Assoc. Gas & Elec., Class A—no par	m 29¼	....	....
BABCOCK & WILCOX, com.	k120	120	149
Binghamton Lt., Ht. & Pwr., pf.	105	....	....
Birmingham Elec. pf.—$7—no par.	100	101	103¼
Blackstone Valley Gas & Elec., pf.	90	90	106
Blackstone Valley G.&E., com.—50.	92	....	....
Blaw-Knox, com.	m 48	45	56
Brazilian Trac., Lt. & Pwr., com.	f 88¼	....	....
Broad River Pwr., pf.	k 93	....	....
Brooklyn Edison, com.	137	133	146¼
Buffalo Gen. Elec., com.—no par.	m 58	n 50	n 77
Buffalo, Niagara & East. Pwr., pf.—25	k 24¼	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	k 24¼	....	....
CALIFORNIA ELEC. GENERATING, pf.	102	102	93
California Ry. & Pwr., pf.	100	88	115
Carolina Pwr. & Lt., pf.—$7—no par	102	102	107
Carolina Pwr. & Lt., com.	m420	n290	n456¼
Cent. & S. W. Ut. 7% pf.—no par	a 94¼	89¼	95
Cent. & S. W. Ut., pr. ln. pf.—no par	a 97¼	95¼	100
Central Ariz. Lt. & Pwr., pf.	102	....	....
Central Ark. Ry. & Lt., 7% pf.	k 98	....	....
Central Ill. Pub. Serv., 6% pf.	88	89	91
Central Ind. Pwr., 7% pf.	88	88	93¼
Central Pwr. & Lt., pf.	93	94	98¼
Central States Elec., 7% pf.	k 93	....	....
Central States Elec., com.	m200	200	230
Century Elec., com.	b116	110	116
Chicago Fuse Mfg., com., no par.	m 31¼	30¼	35
Cincinnati Gas & Elec., com.	g 89¼	88	95
Cities Service, 6% pf.	k 83¼	....	....
Cities Service, pf. B—10.	k 7¼	....	....
Cities Service, pf. BB—100.	k 74	....	....
Cities Service, com.—20.	k 40¼	....	....
Cities Service, Bkr. Shrs.—10.	k 19¼	....	....
Clarion River Pwr., pf.	93	93	95
Cleveland Elec. Illg., 6% pf.	104	103	105¼
Cleveland Elec., Illg., com.	k240	....	....
Colorado Pwr., 7% pf.	k 96	....	....
Columbia Gas & Elec., 7% pf.	k113	112	115
Columbia Gas & E., com.—no par	k 77	63¼	90
Columbia Ry., Gas & Elec., 6% pf.	95	95	96
Columbus Elec. & Pwr., 2d pf.	k102	....	....
Columbus Elec. & Pwr., com.	k185	....	....
Columbus Ry., Pwr. & Lt., 1st. pf.	97	98	99
Columbus Ry., Pwr. & Lt., pf. B.	95	92	95
Col. Ry., Pwr. & Lt., com.—no par.	82	82	85
Commonwealth Edison, com.	a139¼	137¼	144
Commonwealth Pwr., 6% pf.	k 85	....	....
Commonwealth Pwr., com—no par.	k 33¼	28¼	42¼
Conn. Lt. & Pwr., 8% pf.	116	117	121
Conn. Lt. & Pwr., 7% pf.	108	108	113
Cons. Gas of N. Y., pf.—50.	k 57¼	....	....
Cons. Gas of N.Y., com.—no par.	k 91¼	87	104¼
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	c 103	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti 6½% pf.	c109¼	108¼	110
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	c112	109	115¼
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	c127	124	128¼
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par	c 48¼	45	57¼
Cons. Utilities of Dela., 7% pf.	m 85	n 80	n 84
Consumers Pwr., 6% pf.	95¼	95	98
Consumers Pwr., 6.6% pf.	102	101¼	103¼
Continental Gas & Elec., 7% pfc. pf	k 96	....	....
Continental Gas & Elec., 7% pr. pf.	k 92¼	....	....
Continental G.&E., com.—no par.	m 95	85	150
Crocker Wheeler, com.	14	14	19
Crocker Wheeler, pf.	50	50	55
DALLAS PWR. & LT., 7% pf.	102	102	104
Dayton Pwr. & Lt., 6% pf.	98	95	97
Dayton Pwr. & Lt., com.	m420	n180	n460
Detroit Edison, com.	k127	123¼	141¼
Dubilier Condenser & Radio, com. no par	k 4¼	4¼	11
Dubuque Elec., 6% pf.	95	93	97
Duquesne Lt., 7% pf.	114	111¼	114
EAST, N. Y. UTIL. pf.	85	....	....
Eastern New York Util., com.	75	....	....
Eastern States Power, com.	17	23	32¼
Eastern States Pwr., pf.—$7—no par	k 88	....	....
Eastern Tex. Elec., 7% pf.	k102	....	....
East. Tex. Elec., com.—no par.	102	103	107
Edison Elec. Illum. of Boston, com.	d214	207	250
E. Paso Elec., com.—no par	k 80	....	....
E. Paso Elec. pf.	101	102	104
Elec. Bond & Share, 6% pf.	l105¼	103¼	107¼
E. Bd. & Share Sec., com.—no par.	l 64	56¼	86
El. Household Util., com - 10.	a 18¼	16¼	25
Elec. Investors, 6% pf.—no par.	90	92	95
Elec. Investors, com.—no par.	k 35¼	30¼	74¼
Elec. Investors, 10% pd. receipts.	16	....	....
Elec. Pwr. & Lt., ctfs. pf.	k 93	89¼	97¼
Elec. Pwr. & Lt., ctfs. 40% pd.	k100¼	99¼	115
Elec. Pwr. & Lt., ctfs. full pd.	105	105	110¼
Elec. Pwr. & Lt., ctfs., com.—no par	k 18¼	17¼	34¼
Elec. Ry. Securities, com.—no par.	k 5¼	4¼	10
Elec. Refrig.	k 58	52¼	90¼
Elec. Storage Battery, com.—no par.	k 77	71¼	79¼
Elmira Wtr., Lt. & R. R., 7% pf.	97	97¼	99¼
Emerson Elec. pf.	m102¼	100	104¼
Empire Dist. Elec., 6% pf.	80	80	85
Empire Pwr., A.	k 23	....	....
Eng. Pub. Serv., pf.—no par.	k 98	97	104¼
Engr. Pub. Serv., com.—no par.	k 21¼	21	29¼
Eureka Vac. Cleaner, com.—no par.	47	45	53¼
FAIRBANKS MORSE, com—no par	50¼	46	59¼
Fairbanks Morse, pf.	115	108¼	115
Federal Lt. & Trac., com.	k 29¼	28	39¼
Federal Light & Traction, pf.	87	87	89
Federal Utilities, pf.	k 75	....	....
Federal Utilities, com.	k 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	l104¼	105	108
GALVESTON-HOUSTON ELEC., 6% pf.	k 45	....	....
Galveston-Hstn El., com.	k 18	....	....
Gen. Elec., com.	k296	285	386¼
Gen. Elec., special—10.	k 11¼	11	11¼
Gen. G.&E., (Del.) com. A no par.	k 35¼	34	59
Gen. G.&E., (Del.) com. B no par.	k 27¼	....	....
Gen. G.&E., (Del.) A pf. $8—no par	106¼	105¼	110¼
Gen. G.&E., (Del.) A pf. $7—no par	96¼	95¼	99¼
Gen. G.&E., (Del.) B pf.	95	93¼	96
General Public Service, pf.	k100¼	100	106¼
General Public Service, com.	m 13	12¼	16¼
Ga. Lt., Pwr & Rys., 6% pf.	80¼	82	85
Ga. Lt., Pwr. & Rys., com.	m 57¼	56¼	73¼
Ga. Ry. & Elec., 5% pf.	m 70	n 78¼	n 84¼
Ga. Ry. & Elec., com.	m110	n115¼	n115¼
Ga. Ry. & Pwr., 8% pf.	112	112	114
Ga. Ry. & Pwr., 7% pf.	100	101¼	103
Ga. Ry. & Pwr., 4% pf.	m133	....	....
Ga. Ry. & Pwr., com.	k110	....	....
Gt. Western Pwr., 7% pf.	h100¼	....	....
HAVANA ELEC. UTIL., com.	38¼	37¼	44¼
Havana Elec. Util., pf.	69¼	64¼	71¼
IDAHO PWR., 7% pf.	101	103	104
Ill. No. Utilities, 6% pf.	90	88	92
Ill. Pwr. & Lt., 7% pf.	k 97	....	....
Ingersoll Rand.	k 92¼	80¼	105
Int. Combus. Engr., com.—no par.	k 46¼	33¼	64¼
Int. Utilities, class A—no par.	k 31	....	....
Int. Utilities, class B—no par.	k 5¼	4¼	9¼
Interstate Pwr., pf., $7 no par.	k 94	....	....
Interstate Pub. Serv., 7% pf.	94	96¼	97
Iowa Ry. & Lt., 7% pf.	95	98	100
JERSEY CENTRAL PWR. & LT. 7% pf.	95	95¼	96¼
Jersey Central Pwr. & Lt., com.—no par	45	45	50
Johns-Manville, com.—no par.	138¼	130	159
KANSAS CITY PWR. & LT., pf.	108	107¼	111
Kansas Gas & Elec., 7% pf.	l100	99	102
Kelvinator Corp., com.—no par.	m 76	76	89¼
Kentucky Hydro-Elec., pf.	a 93¼	91¼	95
Kentucky Sec., 6% pf.	75	75	77
Kentucky Sec., com.	k100	....	....
Kentucky Utilities, 6% pf.	92	90	95
Keystone Pwr. & Lt. 7% pf.	95	95	97
Kings County Ltg., 7% pf.	100¼	101	106
Kings County, Ltg., 8% pf.	103	105	108
LACLEDE GAS LT., com.	153	146	168
Lehigh Pwr. Sec., com.—no par.	k 12¼	10	23
Long Island Ltg., 7% pf.	103	105	107
Long Island Ltg., com.—no par.	110	120	150
Los Angeles Gas & Elec., 6% pf.	k 96	....	....
Louisville Gas & Elec., Class. A	k23¼	22¼	26¼
MANHATTAN ELEC. SUPPLY.	k 69¼	56	76¼
Manila Elec., com.—no par.	33	27¼	35
Maytag Mfg., com.	k 20¼	19	23¼
Memphis Pwr. & Lt., pf., $7, no par	101	103	105
Metro. Edison, pf.—$6—no par.	k 92	....	....
Metropolitan Edison, pf., $7, no par.	101	102	106
Metropolitan Edison, com., no par.	45	45	50
Middle West Utilities, 7% pf.	a106¼	97¼	111¼
Middle West Utilities, 7% pr. lien pf.	a116	106¼	123¼
Middle West Utilities, com.—no par.	a113¼	109	134¼
Midland Utilities, pr. ln. pf.	a 98¼	98	100
Midland Utilities pf. A.	a 96	96	98
Milwaukee Elec. Ry. & Lt., 7% pf.	100	....	....
Milwaukee Elec. Ry. & Lt., 6% pf.	91	....	....
Minn. Pwr. & Lt., 7% pf.	l 99¼	100	103¼
Miss. Pwr. & Lt., pf.	k101	....	....
Miss. River Pwr., 6% pf.	93	94	96
Miss. River Pwr., com.	k 60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	102	101	105
Mohawk Hudson Pwr., 2nd pf.—$7—no par.	95	90	97
Mohawk Hudson Pwr., com.—no par	m 23¼	21¼	28¼
Montana Pwr., pf.	m114¼	112¼	119¼
Montana Pwr., com.	k 72	69¼	83¼
Montreal Pwr., com.	f 224	....	....
Mountain States Pwr., pf.	k 95	....	....
Mountain States Pwr., com.	k 20	....	....
NASSAU & SUFFOLK, LTG., pf.	92	93	95
National Carbon, com.	m124	n120	n130
National Carbon, pf.	m128	125	128
National Elec. Pwr., pf.	m 91	93	95
National Electric Pwr-A	a 21¼	19¼	26
Nat.-Lt., Ht. & Pwr., com.—no par.	24	22	25
National Lt., Ht. & Pwr., 5% pf.	72	71	73
National Pwr. & Lt., pf., $7—no par.	k 98	....	....
National Pwr. & Lt., com.—no par.	k 19¼	16¼	38¼
National Pub. Serv., 7% pf.	90	90	94
National Pub. Serv., pfc. pf.	95	96	97¼
National Pub. Serv., A com.—no par	19¼	15¼	24
National Pub. Serv., B com.—no par	11¼	10	12¼
Nebraska Pwr., 7% pf.	l102¼	103	105¼
Nevada-Calif. Elec., com.	m 23	18¼	44¼
New Brunswick Pwr., pf.	35	30	40
New England Pub. Serv., pr. ln. pf.	97	98	99¼
New England Pub. Serv., pf.	88	95¼	97
N. J. Pwr. & Lt., 7% pf.	103	104	108
New Orleans Pub. Serv., 7% pf.	97	100	102
New Orleans Pub. Serv., com.—no par.	m 30	n 31	n 38¼
N. Y. Central Elec., 7% pf.	m 97	98	100
Newport News & Hampton Ry., Gas & Elec., com.	110	108	112
Newport News & Hampton Ry., Gas & Elec., pf.	110	109	114
Niagara Falls Pwr., 7% pf.—25.	k 28¼	27¼	28¼
Niagara, Lock. & Ont. Pwr., 7% pf.	108	110	111¼
Niagara, Lock. & Ont. Pwr., com.—no par.	m 60¼	n 60	n 73
Niser Corp., A.—no par.	m 84¼	n 37	n 84¼
Niser Corp., B.—no par.	m 69	60	89¼
No. Amer., 6% pf.—50.	k 49¼	49	50¼
No. Amer., com.—10.	k 47¼	42	67
No. Amer. Edison pf.—no par.	93¼	91¼	95¼
No. Amer., Lt. & Pwr., pf.	90	88	90
N.C. Pub. Serv., pf.—$7—no par.	k 90	....	....
Northeastern Pwr., com.	k 19¼	17¼	38¼
No. Indiana Gas & Elec., pf. A.	97	98	100
No. N. Y. Utilities, 7% pf.	k102¼	....	....
No. Ohio Pwr., com.—no par.	k 13¼	11	26¼
No. Ohio Trac. & Lt., 6% pf.	76	78	81
No. Ohio Trac. & Lt., 7% pf.	86	88	91
No. Ont. Lt. & Pwr., pf.	k 82	....	....
No. Ont. Lt. & Pwr., com.	73	45	70
No. States Pwr., 7% pf.	k100¼	99¼	101¼
No. States Pwr. com.	k103	97	136¼
No. Texas Elec., 6% pf.	k 45	....	....
No. Texas Elec., com.	k 25	....	....
OHIO BRASS, com. B—no par.	74	70	79
Ohio Brass, pf.	100	98	101
Ohio Gas & Elec., 7% pf.	90	92	95
Ohio Pwr., 6% pf.	94	93	95
Ohio Pub. Serv., 6% pf.	90	90	93
Ohio Pub. Serv., 7% pf.	99	98¼	101¼
Ohio River Edison, pf.	99	99¼	101¼
Oklahoma Gas & Elec., pf.	k 96	....	....
PACIFIC GAS & ELEC., 6% pf.	k 98	....	....
Pacific Gas & Elec. com.	k120	118	132¼
Pacific Pwr. & Lt., 7% pf. ex.	f 97¼	98	101¼

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, April 20 lBid, low, high, Wednesday, April 21. mLatest quotations available. n1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday April 17	Low 1926	High 1926
STOCKS—Continued			
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Central Lt. & Pwr., pf.—no par	c 72½	71	91
Penn-Ohio Elec., 7% pf.	95	93	96
Penn-Ohio Pwr. & Lt., 7% pf.	97	94	97
Penn-Ohio Pwr. & Lt., 8% pf.	102	100	106
Penn Pwr. & Lt.—$7—no par.	l104	103	106½
Penn Pub. Serv., 7% pf.	99	96	100
Penn Pub. Serv., 6% pf.	86	85	90
Penn Wtr. & Pwr., com.	e140	150	165
Phila. Co., 5% pf.—50.	m38	37½	38
Phila. Co., 6% pf.—50.	49½	47½	50½
Phila. Co., com.—50	k 72½	59½	76½
Phila. Elec., com.—25	c 43½	41½	67½
Pittsburgh Utilities, pf.—10	k 19½	14½	19½
Portland Elec. Pwr., 7% pf.	97	97	98
Portland Elec. Pwr., 6% pf.	72	71	75½
Portland Elec. Pwr., com.	k 38	....	....
Portland Ry., Lt. & Pwr.,pf.	m 72½	....	....
Portland Ry., Lt. & Pwr., com.	m 49	....	....
Potomac Elec. Pwr., pf.	m106	....	....
Pwr. Corp. of N. Y., 7% pf.	m110	n 96	n112
Pwr. Corp. of N.Y., com—no par.	m 79	77½	90½
Pwr. Sec., pf.—no par.	k 14	....	....
Pwr. Sec., com.—no par.	k 5	....	....
Pub. Serv. of N. J., 7% pf.	k105	103½	108½
Pub. Serv. of N. J., 8% pf.	k117½	115	119
Pub. Serv. of N. J., com.—no par.	k 77½	72	92½
Pub. Serv. of No. Ill., 6% pf.	c103	100½	103
Public Serv. of No. Ill., 7% pf.	a114	112	116½
Pub. Serv. of No. Ill., com.—no par	a131½	130	137
Pub. Serv. of No. Ill., com.	a129	129	131½
Pub. Serv. of Okla., 7% pf.	96	92	95
Pub. Serv. Elec. & Gas, 6% pf.	k 99	97	99½
Puget Sound Pwr. & Lt., 7% pf.	k106	....	....
Puget Sound Pwr. & Lt., 6% pf.	k 85	....	....
Puget Sound Pwr. & Lt., com.	k 48	....	....
RADIO CORP. OF AM., pf.—50.	45½	44½	47½
Radio Corp. of Amer., com.—no par.	k 35½	32	46½
Republic Ry. & Lt., pf.	k102	....	....
Republic Ry. & Lt., com.	k 85	....	....
Rochester Gas & Elec., 5% pf.	m 95	80	98
Rochester Gas & Elec., 6% pf.	101	100	102
Rochester Gas & Elec., 7% pf.	104	105	107
ST. JOSEPH RY., LT., HT. & PWR., pf.	65	60	65
Servel Corp., Class A	k 21	15½	30½
Servel Corp., Class B—no par	k 35	....	....
Sierra Pacific Elec., com.	k 25	23	28½
Sioux City Gas & Elec., 7% pf.	98	96	98
S. E. Pwr. & Lt., pf.—$7—no par.	97½	97	100
S. E. Pwr. & Lt., com.—no par.	k 24½	21½	46½
So. Calif. Edison, 8% pf.	130	135	140
So. Calif. Edison, 7% pf.	k110	....	....
So. Calif. Edison, 6% pf.	k 98	....	....
So. Calif. Edison, com.	k119	115	148
Southern Cities Utilities, 7% pf.	k 85	....	....
Southern Cities Utilities, com.	k 31	....	....
Southern Pwr. & Lt. of Md., pf.	m107	....	....
Southern Pwr. & Lt. of Md., com.	m 32	....	....
Southwestern Lt. & Pwr., A	k 55	....	....
Southwestern Lt. & Pwr., B	k 45	....	....
Southwestern Lt. & Pwr., $6 pf.	k 79	....	....
Southwestern Pwr. & Lt., 7% pf.	k 98	....	....
Springfield (Mo.) Ry. & Lt., 7% pf.	95	....	....
Standard Gas & Elec., 8% pf.	55½	53½	57½
Standard Gas & Elec., 7% pf.	k 99	....	....
Standard Gas & Elec., com.—no par.	k 53	51	69
Standard Pwr. & Lt., 7% pf.	k 92	....	....
Superheater, com.—no par.	k133	....	....
Syracuse Lighting, 7% pf.	102	105	107
Syracuse Lighting, 8% pf.	118	....	....
Syracuse Lighting, com.	285	260	315
TAMPA ELEC., com.	k270	....	....
Tenn. Elec. Pwr., 6% pf.	k 85	....	....
Tenn. Elec. Pwr., 7% pf.	k 98	....	....
Tenn. Elec. Pwr., pf.—$6—no par.	m 80	....	....
Tenn. Elec. Pwr., com.—no par.	m 65	....	....
Terre Haute, Ind. & East Trac., pf.	20	23	37
Terre Haute, Ind. & East. Trac., com	3	3	5
Tex. Pwr. & Lt., 7% pf.	l102½	102	105
Tide Water Pwr., 8% pf.	k101	....	....
Timken Roller Bearing, com—no par	k 49½	44½	56½
Toledo Edison, 8% pf.	111	112	114
Toledo Edison, 7% pf.	102	101	103
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	88½	87½	89
UNITED GAS & ELEC., 6% pf.	94½	94	97
United Gas & Elec., com.—no par.	m57	56	66
United Gas & Elec. (N.J.), 5% pf.	68	70	75
United Gas Impr.—50	c 90½	84½	144½
United Lt. & Pwr., pf.—$4—no par.	45	....	51
United L. & P. pf.—$6.50—no par.	84	81	91
United Lt. & Pwr., com., A—no par	k 64½	64½	143½
United Lt. & Pwr., com., B—no par	67	140	165
Utah Pwr. & Lt., 7% pf.	l100	99	103½
Utica Gas & Elec., 7% pf.	104	103	105
Utica Gas & Elec., com.	200	....	....
Utilities Pwr., & Lt., 7% pf.	k 92½	....	....
Utilities Pwr. & Lt., com. B—no par.	14½	14	18
VERMONT HYDRO - ELEC., 7% pf.	93	95	96
Virginian Pwr., 7% pf.	103	102	104
Virginian Pwr., com.	65	....	....
Virginia Ry. & Pwr., com.	m150	150	150
WAGNER ELEC., pf.	b 75	70	85
Wagner Elec., com.—no par	b 22	20	34½
Washington Ry. & Elec., com.	170	....	....
Washington Ry. & Elec., pf.	89	....	....
Washington Wtr. Pwr., com.	127	130	134
West Mo. Pwr., 7% pf.	k 91	....	....
West Penn., 7% pf. temp. ctfs.	m 99	95½	101
West Penn, com.	m125	118	130
West Penn Elec., pf.	k 98	96½	100½
West Penn Elec., Class A	k 90	88½	97
West Penn Pwr., pf.	110	108	112
West Va. Lt., Ht. & Pwr., 7% pf.	95	95	98
West Va. Utilities, 7% pf.—50	42	43	45
Western Pwr., 7% pf.	k 93½	....	....
Western Pwr., com.—no par	m 80	n 34	n102
Western States Gas & Elec., 7% pf.	k 90	....	....
Western States Gas & Elec., com	k 17	....	....
Westinghouse El. & Mfg., com—50.	k 67	65½	79½
Weston Elec. Instrument, Class. A	29½	27½	31½
Weston Elec. Instrument, com.	k 15½	13½	19
Wheeling Elec., pf.	90	91	93½
Wis.-Minn. Lt. & Pwr., 7% pf.	m 90	....	....
Wis. Pwr., Lt. & Ht., 7% pf.	90	85	90
Worthington Pump, pf. A	73	73	80
Worthington Pump, pf. B	56	53	65
Worthington Pump, com.	k 22	20½	44½
YADKIN RIVER PWR., 7% pf ex. div.	l102½	102	105
Yale & Towne, com.—25	k 62½	60½	64½
BONDS			
ABITIBI PWR., & PAPER	6s 1940	k101½	....
Adir. Elec. Pwr.	5s 1962	k101	....
Adir. Pwr. & Lt.	6s 1950	k105½	....
Adir. Pwr. & Lt.	5s 1930	97	97 99
Ala. Pwr.	5s 1946	99½	99 100½
Ala. Pwr.	5s 1951	97	97 99½
Ala. Pwr.	6s 1951	104½	104½ 105½
Ala. Trac., Lt. & Pwr.	5s 1962	m111	112 124
Aluminum Co. of Amer.	7s 1933	107½	106½ 107½
Amer. Bosch Magneto	8s 1936	m103	2 93
Amer. Gas & Elec.	5s 2007	92	92 93
Amer. Gas & Elec.	6s 2014	98½	99 100½
Amer. Pwr. & Lt.	6s 2016	k 98	96 98
Amer. Pub. Serv.	6s 1942	99½	98½ 100½
Amer. Wtr. Wks. & Elec.	5s 1934	k 96½	....
Amer. Wtr. Wks. & Elec.	6s 1975	k 94½	92½ 94½
Anaconda Copper	6s 1929	k103	102½ 103½
Anaconda Copper	6s 1953	k103½	....
Anaconda Copper	7s 1938	k105	....
Appalachian Pwr.	5s 1941	k 99½	....
Appalachian Pwr.	6s 2024	94	93½ 95
Appalachian Pwr.	7s 1936	106½	105 106½
Arizona Pwr.	6s 1933	100½	99½ 101
Arizona Pwr.	6s 1947	96	95½ 97
Ark. Central Pwr.	6s 1948	103	102 103½
Ark. Lt. & Pwr.	6s 1945	k104½	....
Ark. Lt. & Pwr.	6s 1954	k100½	....
Assoc. Gas & Elec.	5s 1965	k 94½	92½ 94½
Assoc. Gas & Elec.	6½s 1954	k101	....
BERLIN CITY ELEC.	6½s 1928	99	98 99½
Berlin City Elec.	6½s 1929	98	97 98½
Binghamtpn Lt., Ht. & Pwr.	5s 1946	k 99	....
Birmingham Elec.	6s 1954	103½	102½ 104
Birmingham Ry., L. & P.	4½s 1954	91½	88 92½
Broad River Pwr.	6½s 1934	100	100 102
Brooklyn Edison	5s 1949	k104½	....
Brooklyn Edison	6s 1930	104½	103½ 106½
Buffalo Gen. Elec. 1st	5s 1939	102	101½ 102½
Buffalo G. E., 1st & Ref.	5s 1939	101½	101½ 102½
Buffalo G. E.	5s 1956	102½	99½ 102½
Burlington Ry. & Lt.	5s 1932	96½	96 97½
Butte Elec. & Pwr.	5s 1951	k100½	....
CALIF. ELEC. GEN.	5s 1948	k101	....
Calif. Gas & Elec.	5s 1937	100½	100½ 101½
Calumet Gas & Elec.	5½s 1960	98½	97½ 99
Canadian Lt. & Pwr.	5s 1949	60	56 64
Canton Elec.	5s 1937	100½	100 101
Carolina Pwr. & Lt.	5s 1938	101	100½ 101½
Carolina Pwr. & Lt.	6s 1953	104½	104½ 105½
Cedar Rap. Mfg. & Pwr.	5s 1953	100	99½ 100½
Central Ark. Ry. & Lt.	5s 1928	99½	99 100½
Central Ga. Pwr.	5s 1938	95	95 96½
Central Ill. Lt.	5s 1943	k100½	....
Central Ill. Pub. Serv.	5s 1952	92½	92 93½
Central Ill. Pub. Serv.	5½s 1950	96½	96 97½
Central Ill. Pub. Serv.	6s 1944	100½	99 101½
Central Ind. Pwr.	6s 1947	98½	98 99½
Central Pwr. & Lt.	6s 1944	99½	99½ 101
Central Maine Power	5s 1939	99½	98½ 100
Central N. Y. Gas & El.	5s 1941	k 98	....
Central Pwr. & Lt.	6s 1946	m101½	....
Central Pwr. & Lt.	6½s 1952	k104	....
Central States Elec.	6s 1945	k 91½	91½ 98½
Chattanooga Ry. & Lt.	5s 1956	88½	81 90
Cincinnati Gas & Elec.	5s 1956	102½	102 103½
Cincinnati Gas & Elec.	5½s 1961	104½	102½ 104½
Cities Service	6s 1966	k 91½	91½ 94
Cities Service	7sB 1966	k185	....
Cities Service	7sC 1966	k129	125½ 131
Cities Service	7sD 1966	k103½	101½ 104
Cities Service	7sE 1966	k109	....
Cities Service Pwr. & Lt.	6s 1944	k 95½	93½ 95½
City L. & T., Sedalia, Mo	5s 1952	84½	83 85½
Cleveland Elec. Illum.	5s 1939	102½	102½ 103½
Cleveland Elec. Illum.	5s 1954	k103	....
Cleveland Elec. Illum.	7s 1941	111	110 112½
Colorado Pwr.	5s 1953	97½	95½ 98
Columbia Gas & Elec.	5s 1927	k100½	....
Columbia Ry., Gas & El.	5s 1936	93	92½ 95
Columbus, Dela. & Marion Elec.	5s 1937	85	83½ 86
Columbus Elec. & Pwr.	6s 1937	94	93½ 96
Columbus Ry., Pwr. & Lt.	6s 1947	k102	....
Columbus Ry., Pwr. & Lt.	5s 1940	k 98	....
Columbus Ry., Pwr. & Lt.	6s 1941	k104	....
Commonwealth Edison	5s 1943	k102½	....
Commonwealth Edison	5s 1953	100	99½ 101
Commonwealth Edison	5s 1954	k100	....
Commonwealth Pwr.	5s 1939	k 91½	....
Commonwealth Pwr.	6s 1972	k 96	....
Commonwealth Pwr.	6s 1947	k103½	....
Community Pwr. & Lt.	6s 1950	99½	98 99½
Conn. Ry. & Ltg.	4½s 1951	84½	90½ 92
Consol. Cities Lt., Pwr. & Trac.	5s 1962	80	80 82½
Consol. Elec.	5s 1955	97½	98 99
Consol. Gas of N. Y.	5½s 1945	k105½	....
Con. Gas. Elec. Lt. & Pwr. of Balti.	4½s 1935	97½	97½ 98½
Con. Gas. Elec. Lt. & Pwr. of Balti. (notes)	6s 1949	107½	105½ 107½
Con. Gas. Elec. Lt. & Pwr. of Balti	5s 1965	m100½	100 101½
Con. Gas. Elec. Lt. & Pwr. of Balti. (notes)	5½s 1952	105½	105 106
Con. Gas, Elec. Lt. & Pwr. (notes)	6½s 1951	m109½	109 109½
Consumers Elec. L. & P.	5s 1936	k 97½	....
Consumers Pwr.	5s 1936	k100½	....
Consumers Pwr.	5s 1952	k100½	....
Consumers Pwr.	5½s 1954	k103½	....
Continental Gas & Elec.	5s 1927	k100	....
Continental Gas & Elec.	6s 1947	k101	....
Continental Gas & Elec.	6½s 1964	k 98	....
Continental Gas & Elec.	7s 1954	k103	....
Cumberland Cty. Pw.& Lt.	5s 1942	95½	94 96½
DALLAS PWR. & LT.	6s 1949	104½	104 105
Dayton Ltg.	5s 1937	100	100 101
Dayton Pwr. & Lt.	5s 1941	k 101	....
Defiance Gas & Elec.	5s 1942	98½	98 99
Denver Gas & Elec.	5s 1949	99	98 100
Denver Gas & Elec. Lt.	5s 1951	k 95½	....
Des Moines Elec.	5s 1938	100½	99 100½
Detroit Edison	5s 1933	101½	101 102½
Detroit Edison	5s 1940	102½	100½ 102½
Detroit Edison	5s 1949	101½	100 102½
Detroit Edison	5s 1955	101½	100½ 101½
Detroit Edison	6s 1932	m125	125 135
Detroit Edison	6s 1940	k108	....
Detroit Edison	7s 1928	m134	....
Detroit Edison	7s 1929	m130	130 130
Detroit Edison	7s 1930	m125½	125½ 138½
Dominion Pwr. & Trans.	5s 1932	96	95 97
Driver-Harris	8s 1931	96½	95 98½
Dubuque Elec.	6s 1942	101½	102 103½
Duke-Price Pwr.	6s 1949	103	102 104
Duquesne Lt.	6s 1949	105½	....
Duquesne Lt.	5½s 1949	k105½	....
Durham Pub. Serv.	7s 1949	100½	99 101½
EAST PENN. ELEC.	6s 1953	104	105 106
East Oregon Lt. & Pwr.	6s 1929	100	100 101
East. Tex. Elec.	5s 1942	k 97	....
Economy Lt. & Pwr.	5s 1956	98½	99 100
Edison Elec. Illum. of Boston (notes)	4½s 1928	99½	99½ 100½
Edison Elec. Illum. of Bklyn.	4s 1939	95	93 99½
Edison El. Illum. (N.Y.)	5s 1995	105½	103 105
El Paso Elec.	5s 1932	m102	....
El Paso Elec.	5s 1950	96½	95 96½
El. Pwr. Corp. (Germany)	6½s 1950	87½	85½ 89½
Elec. Refrigeration	6s 1936	k102½	100½ 107
Elmira Wtr., Lt. & R.R.	5s 1956	96	96 97
Empire Dist. Elec.	5s 1949	93½	92 93½
Erie Ltg.	5s 1967	99	99 100½
Evansville G. & El. Lt.	5s 1932	99	99 100
FEDERAL LT. & TRAC.	5s 1942	94½	92½ 97½
Federal Lt. & Trac.	6s 1942	102½	100 104½
Federal Lt. & Trac.	6s 1954	94½	93 96
Florida Power & Light	5s 1954	k 93½	91½ 94
Florida Publ. Service	6s 1955	97	97 99
Florida Public Service	6½s 1949	99	100 103
Ft. Smith Lt. & Trac.	5s 1936	k 80½	....
Ft. Worth Pwr. & Lt.	5s 1931	100½	99 100½
GALVESTON ELEC.	5s 1940	88	89 92
General Elec.	3½s 1942	87	87 88½
Georgia Carolina Pwr.	5s 1952	89½	87 91
Ga. Lt., Pwr. & Rys.	5s 1941	88	88 92
Ga. Ry. & Elec.	5s 1932	99½	98½ 100½
Ga. Ry. & Elec.	5s 1949	94½	94½ 97
Ga. Ry. & Pwr.	5s 1954	98	96 99
Ga. Ry. & Pwr.	6s 1947	k104	....
Ga. Ry. & Pwr.	7s 1941	k105	....
German Gen. Elec.	6½s 1940	97½	93½ 99½
German Gen. Elec.	7s 1945	98	95 98½
Great Cons. Elec. Pwr. (Japan)	6½ 1950	k 85½	85 86
Great Cons. Elec. Pwr. (Japan)	7s 1944	k 91½	....
Great Falls Pwr.	5s 1940	102½	101½ 104½
Great Northern Pwr.	5s 1935	99½	98½ 100
Great Western Pwr.	5s 1946	k 98½	....
Great Western Pwr.	5½s 1955	99½	99 101
Great Western Pwr.	6s 1949	102½	102 103½
Great Western Pwr.	6s 1952	k102½	....
HAMBURG ELEC.	7s 1935	k 96½	94 96½
Havana Elec. R., Lt. & P.	5s 1954	94½	92½ 94½
Holtwood Pwr.	6s 1954	104½	100 104½
Houston Ltg. & Pwr.	5s 1931	100	99 101
Houston Ltg. & Pwr.	5s 1953	96½	90½ 95½
Houston Ltg. & Pwr.	5½s 1954	100½	99½ 102½
Hydraulic Pwr.	5s 1951	101½	101½ 102
Hydraulic Pwr.	5s 1950	101½	101½ 103
IDAHO PWR.	5s 1947	97½	96 98½
Ill. Elec. Pwr.	6s 1943	103	102 103½
Ill. Pwr.	5s 1933	k 95½	....
Ill. Pwr.	6s 1944	k 99	....
Ill. Pwr. & Lt.	5½s 1954	97½	97½ 99
Ill. Pwr. & Lt.	6s 1953	101½	100½ 102½
Ill. Pwr. & Lt.	7s 1953	102	102 103½
Ind. Elec.	6s 1947	98½	98 100
Ind. Gen. Serv.	5s 1948	98	96½ 98½
Ind. Lighting	4s 1958	83½	82½ 84
Indiana & Mich. Elec.	5s 1955	97½	96 98½
Indiana & Mich. Elec.	5s 1957	99½	97½ 100
Ind. Pwr.	7½s 1941	m105½	n104 n106
Ind. Service	5s 1950	92½	91½ 93
Ind. Service	6s 2020	83	83 88½
Ingersoll-Rand	5s 1935	100	....
International Pwr. Sec.	6½s 1955	l 91	....
Interstate Elec.	6s 1933	96	94 98½
Interstate Pwr.	6s 1944	k 99	....
Interstate Pwr.	7s 1934	k 99½	....
Interstate Pub. Serv.	6s 1948	99½	98 99½
Iowa Ry. & Lt.	5s 1932	98½	97½ 99½
Iowa Southern Utilities	5½s 1950	93	94 96
JERSEY CENT. PWR. & LT.	5½s 1945	96	95 98
KANSAS CITY PWR. & LT.	5s 1952	k103½	....
Kansas Elec. Pwr.	6s 1937	k101	....
Kansas Elec. Pwr.	6s 1943	101½	99½ 102
Kansas Gas & Elec.	6s 1952	104½	101½ 105½
Kansas Gas & Elec.	6s 2022	93	92½ 93½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high. lBid,' low, high. Wednesday, April 21. mLatest quotations available. n1925. Tuesday, April 20.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday April 17	Low 1926	High 1926
BONDS (Continued)				
Kentucky Hydro Elec....	6s	1949	100¼	99½	101½
Kentucky Utilities.....	6s	1949	101½	99½	101½
Kings Cty. Elec. L. & P..	5s	1937	103½	102	103½
Kings Cty. Elec. L. & P..	6s	1997	123½	120½	123
Kings County Ltg.....	5s	1954	99½	98½	100½
Kings County Ltg.....	6½s	1954	108½	106	110
Knoxville Ry. & Lt.....	5s	1946	96½	95½	97
LACLEDE GAS LT.....	5s	1934	102	100½	101½
Laclede Gas Lt.....	5½s	1953	*k* 99½	98	100½
Laurentian Pwr.....	6s	1936	100	100	101
Laurentide Pwr.....	5s	1946	99½	100	102
Lehigh Pwr. Sec.....	6s	2026	*k* 95	93	95½
Lincoln Gas & Elec.....	5s	1941	94	92½	94½
Long Island Ltg.....	5s	1936	*k*100	....	....
Long Island Ltg.....	6s	1954	101½	99½	102
Long Island Ltg.....	6s	1948	107	104½	106
Los Angeles Gas & Elec..	5s	1939	*k*100	....	....
Los Angeles Gas & Elec..	5½s	1943	100½	99	100½
Los Angeles Gas & Elec..	5½s	1947	*k*100	....	....
Los Angeles Gas & Elec..	5½s	1949	100½	99	101
Los Angeles Gas & Elec..	6s	1942	104½	102½	104
Louisiana Pwr.....	6s	1944	99	98½	100
Louisville Gas & Elec....	5s	1952	*k* 99½	....	....
Louisville Gas & Elec....	5½s	1954	103	102	103½
Lower Austrian Hydro El.	6½s	1944	85	85	87
Luzerne Cty. Gas & El...	5s	1948	98	97½	99
Luzerne Cty. Gas & El...	7s	1944	105	103½	105½
Luzerne Cty. Gas & El...	6s	1954	103½	102	104
MADISON RIV. PWR..	5s	1935	100½	100	101
Manila Elec.....	7s	1942	115	102	115½
Manila Elec. Ry. & Ltg..	5s	1953	91½	89½	94
Manitoba Pwr.....	7s	1941	105	103½	105½
Memphis Pwr. & Lt.....	5s	1948	99½	99	100½
Metropolitan Edison.....	6s	1952	107½	104	108
Metropolitan Edison.....	5s	1953	100½	96½	100½
Metropolitan Pwr.....	6s	1953	104½	102½	104½
Michigan Lt.....	5s	1946	*k*100	....	....
Michigan No. Pwr.....	5s	1941	98½	97	100
Milwaukee El. Ry. & Lt..	5s	1926 *m*	99½	99½	99½
Milwaukee El. Ry. & Lt..	4½s	1931	98½	97	99
Milwaukee El. Ry. & Lt..	5s	1951	*k* 99½	....	....
Milwaukee El. Ry. & Lt..	5s	1961	*k* 95½	....	....
Milwaukee El. Ry. & Lt..	6s	1953	104½	100½	104½
Minn. Pwr. & Lt.....	5s	1955	96½	95½	97
Minn. Pwr. & Lt.....	6s	1950	105	104	105½
Miss. Power.....	5s	1955	93½	92	94
Miss. River Pwr.....	5s	1951	99½	99	100½
Miss River Pwr.....	7s	1935	101½	102	103
Mo. Edison Elec.....	5s	1927 *m*	100½	100½	100½
Mobile Elec.....	5s	1946	*k* 98	....	....
Monongahela W. Pa. Pub. Service.....	5½s	1953	96	95	97½
Montana Pwr.....	5s	1943	*k*101½	....	....
Montgomery Lt. & W.P..	5s	1943 *m*	93	*n* 86½	*n* 93½
Montreal Lt., Ht. & Pwr.	4½s	1932	97	97	98½
Montreal Lt., Ht. & Pwr.	5s	1933	99½	99½	101
Montreal Pub. Serv.....	5s	1942	94½	94	95½
Mountain States Pwr.....	6s	1938	99½	98½	100
NASHVILLE RY. & LT.	5s	1953	97½	96½	98½
Nashville Ry. & Lt.....	5s	1958	92½	90½	92½
Nassau Lt. & Pwr.....	5s	1927	99½	98½	100½
Nassau & Suffolk Ltg....	5s	1945	91½	89½	92½
National Elec. Power....	6s	1945	92½	92½	94
National Pwr. & Lt.....	7s	1972	*k*103	....	....
National Pub. Serv.....	6½s	1955	94½	94½	97
Nebraska Pwr.....	5s	1949	100½	99	101½
Nebraska Pwr.....	6s	2022	96½	94½	97½
Nevada-Calif. Elec.....	6s	1946	*k* 99	....	....
Nevada-Calif. Elec.....	6s	1950	99½	98½	100
New Brunswick Pwr.....	5s	1937	83½	81½	85
New England Pwr.....	5s	1951	103½	100½	104½
New Jersey Pwr. & Lt....	5s	1936	99	96½	99
New Orleans Pub. Serv...	4½s	1935	88	87	88½
New Orleans Pub.Serv.,B.	5s	1952	*k* 93½	....	....
New Orleans Pub. Serv...	5s	1955	93½	90½	94½
New Orleans Pub. Serv...	6s	1949	91	90	92½
N. Y. & Queens El. L.&P..	5s	1930	101½	100½	103½
N.Y. & Westchester Ltg..	4s	2004	80	79½	81½
N.Y. & Westchester Ltg..	5s	1954	98	97½	98½
New York Edison.....	6½s	1941	116½	115	116½
New York Edison.....	5s	1944	*k*103½	....	....
N.Y. Gas & El. L., H.&P.	5s	1948	*k*104½	....	....
N.Y. Gas & El. L., H.&P.	4s	1949	*k* 91½	....	....
N.Y. State Gas & Elec...	5½s	1962	101	100	101
Newport News & Hampton Ry., Gas & Elec....	5s	1944	89	89½	91
Niagara Falls Pwr.....	5s	1932	102½	100½	102½
Niagara Falls Pwr.....	6s	1932	105½	104½	106½
Niagara Falls Pwr.....	6s	1950	105½	105	106½
Niagara, Lock. & Ont. Pwr.	5s	1954 *m*	98½	*n*104½	*n*110
Niagara, Lock. & Ont. Pwr.	5s	1955	100½	99	101
Niagara, Lock. & Ont. Pwr.	6s	1958 *m*	106	....	....
Norfolk Ry. & Lt.....	5s	1949	95½	94	96½
No. Amer. Edison.....	6s	1952	*k*104½	....	....
No. Amer. Edison.....	6½s	1948	105½	....	....
No. Amer. Lt. & Pwr.....	7s	1954	98½	99	100½
North Caro. Pub. Serv...	5s	1934	*k* 93	....	....
North Caro. Pub. Serv...	6s	1954	95	94½	96
North Caro. Pub. Serv...	6½s	1944	99	98	100½
North Shore Elec.....	5s	1940	100	98½	100½
No. Calif. Pwr.....	5s	1948	100	99½	101½
No. Ind. Gas & Elec.....	5s	1929	99½	99	100
No. Ind. Gas & Elec.....	6s	1952	104½	102½	105
Northern N. Y. Utilities..	5½s	1949	100	100	101½
No. Ohio Pwr.....	7s	1935	*k* 93½	....	....
No. Ohio Trac. & Lt.....	4s	1933	88½	87	89
No. Ohio Trac. & Lt.....	5s	1956	84	84	86
No. Ohio Trac. & Lt.....	6s	1926	99½	99	100
No. Ohio Trac. & Lt.....	6s	1947	95½	92½	96
No. Ontario Lt. & Pwr....	6s	1931 *m*	100	*n* 95½	*n*100½
No. States Pwr.....	6½s	1933	*k*110½	108	132
No. States Pwr. (notes)....	6½s	1933	*k*103	102½	104
No. States Pwr.....	6s	1948	*k*103	....	....
No. States Pwr.....	6s	1941	105½	....	....
No. States Pwr.....	5s	1941	*k* 99½	....	....
No. Tex. Elec.....	5s	1940	72	72	75
Northwestern Elec.....	6s	1935	102½	102	103½
Northwestern Pub. Serv..	6½s	1948	101½	99½	101½
Nova Scotia Tr. & Pwr...	5s	1946	88	88	90
OHIO PWR.....	5s	1952	95½	94	95½
Ohio Pwr.....	6s	1953	104½	103½	104½
Ohio Pwr.....	6s	2024	96½	95½	97½
Ohio Pwr.....	7s	1951	106	105½	106
Ohio Pub. Serv.....	5s	1954	94	92½	94½
Ohio Pub-Serv.....	6s	1953	101½	101	102½
Ohio Pub. Serv.....	7½s	1946	113½	112½	113½
Ohio Pub. Serv.....	7s	1947	111½	110½	111½
Ohio River Edison.....	6s	1948	*k*104	....	....
Okla. Gas & Elec.....	5s	1950	94	93	94½
Okla. Gas & Elec.....	6s	1940	*k* 96½	....	....
Ontario Pwr. of Niagara Falls.....	5s	1943	101	99½	101
Ontario Transmission.....	5s	1945	99½	99½	99½
Ozark Pwr. & Wtr.....	5s	1952	80½	77	81½
PACIFIC COAST PWR..	5s	1940	99½	99	100½
Pacific Gas & Elec.....	5s	1942	*k* 99½	....	....
Pacific Gas & Elec.....	5s	1955 *m*	93½	*n* 94	*n* 95½
Pacific Gas & Elec.....	5½s	1952	*k*103½	....	....
Pacific Gas & Elec.....	6s	1941	*k*107	....	....
Pacific Lt. & Pwr.....	5s	1942 *m*	100½	....	....
Pacific Lt. & Pwr.....	5s	1951	100½	100	101½
Pacific Pwr. & Lt.....	5s	1930	*k*100	....	....
Pacific Pwr. & Lt.....	5s	1953 *m*	96½	....	....
Parr Shoals Pwr.....	5s	1952	97	95	98½
Paterson & Passaic G.&E.	5s	1949	103	100	101½
Penn Central Lt. & Pwr...	6s	1953	103½	102½	105
Penn Edison.....	5s	1946	98½	96½	98½
Penn. Elec.....	6s	1955 *m*	105	92	105
Penn Elec.....	6½s	1954 *m*	105	97	100½
Penn.-Ohio Edison.....	6s	1950	*k* 99½	98½	106
Penn Ohio Elec.....	6½s	1938	107	105	107
Penn Ohio Pwr. & Lt.....	5½s	1954	*k* 99½	....	....
Penn Ohio Pwr. & Lt.....	6s	1939	98	97	98½
Penn Pwr. & Lt.....	5s	1952	98½	97½	99
Penn Pwr. & Lt.....	5s	1953	*k* 99½	97½	99½
Penn Pwr. & Lt.....	6s	1953	105½	105	106
Penn Pwr. & Lt.....	7s	1951	105½	105½	106½
Penn Pub. Serv.....	5s	1954	97½	96	98½
Penn Pub. Serv.....	6s	1947	104½	103	105
Penn Wtr. & Pwr.....	5s	1940	101½	101½	102½
Penn Wtr. & Pwr.....	5½s	1953	103½	102½	103½
Phila. Co.....	6s	1944	*k*104	....	....
Phila. Co.....	5½s	1938	*k*100½	....	....
Phila. Co.....	5s	1951	98½	97½	99½
Phila. Co.....	5s	1949 *m*	104½	103½	104½
Phila. Elec.....	5s	1966	*c*104	102	104½
Phila. Elec.....	4s	1966 *m*	86½	84	86½
Phila. Elec.....	5s	1960	*c*103	102	103½
Phila. Elec.....	6s	1941	*c*107½	107½	108½
Phila. Elec.....	5½s	1947	107½	106½	107½
Phila. Elec.....	5½s	1953	*c*107½	103½	107½
Phila. Elec. Pwr.....	5½s	1972	*k*101½	100	101½
Portland Elec. Pwr.....	6s	1947	101	99	102½
Portland Gen. Elec.....	5s	1935	100½	99½	100½
Portland Ry., Lt. & Pwr..	5s	1942	92½	88½	93
Portland Ry., Lt. & Pwr..	6s	1947	101½	99	102½
Portland Ry., Lt. & Pwr..	7½s	1946	107½	106½	108½
Potomac Edison.....	6s	1949	100	99	100½
Potomac Edison.....	6½s	1948	103½	103	104
Potomac Elec. Pwr.....	5s	1929	99½	99½	100½
Potomac Elec. Pwr.....	5s	1936	99½	99½	100½
Potomac Elec. Pwr.....	6s	1953 *m*	106½	....	....
Potomac Elec. Pwr.....	7s	1941 *m*	106½	....	....
Power Corp. of N. Y.....	6s	1942	100½	101	101½
Power Corp. of N. Y.....	6½s	1942	103½	104	105½
Power Securities.....	6s	1949	*k* 76	....	....
Pub. Lt. & Pwr.....	5s	1945	68	68	73
Pub. Serv. Co. of Colo...	5½s	1954	94½	95	96½
Pub. Serv. Co. of Colo...	6s	1953	100½	100	101½
Pub. Serv. Co. of Colo...	7s	1933	100½	101½	102½
Pub. Serv. Corp. of N.J..	5s	1959 *m*	101	104½	105
Pub. Serv. Corp. of N.J..	6s	1944	*k*102½	....	....
Pub. Serv. Co. of No. Ill..	5s	1956	98	98	99½
Pub. Serv. Co. of No. Ill..	5½s	1962	103½	103½	105
Pub. Serv. Co. of No. Ill..	5½s	1964	103½	103½	105½
Pub. Serv. Co. of Okla....	6s	1949	101½	98½	102
Pub. Serv. Elec. & Gas...	5½s	1959	*k*105	....	....
Pub. Serv. Elec. & Gas...	5½s	1964	*k*105	....	....
Pub. Util. Evansville, (Ind.)	6s	1929	*k*100	....	....
Puget Sound Pwr.....	5s	1933	100½	99	101½
Puget Sound Pwr. & Lt...	5½s	1949	*k* 99	....	....
QUEBEC PWR.....	6s	1953	102½	101½	103
Queensborough Gas & E..	5s	1952	100	99½	100½
Queensborough Gas & E..	6s	1953	104½	104	105½
RHINE-WESTPHALIA ELECTRIC PWR....	7s	1950	*k* 96	93½	96
Rio de Janeiro Tram., Lt. & Pwr.....	5s	1935	94	93	94½
Robbins & Myers.....	7s	1952	61	60	68½
Rochester Gas & Elec....	5½s	1948	105½	105½	106
Rochester Gas & Elec....	7s	1946	113	112½	114
Rochester Ry. & Lt.....	5s	1954	100½	100	101½
Rockford Elec.....	5s	1939	100½	99½	100½
ST. MAURICE PWR...	6½s	1953	108	108	109½
St. Paul Gas Lt.....	5s	1944	100½	100½	101½
St. Paul Gas Lt.....	5½s	1954	101½	101	102½
St. Joseph Ry., Lt., H.&P.	5s	1937	94	91½	97
Salt River Valley Wtr....	6s	1938	*k*100	....	....
Salmon River Pwr.....	5s	1952	100½	100½	101½
San Antonio Gas & Elec..	5s	1949	96½	96	97½
San Antonio Pub. Serv...	6s	1952	102½	101½	103½
San Diego Cons. G. & E....	5s	1939	*k*100	....	....
San Diego Cons.G.&E....	6s	1939	102½	101	102½
San Joaquin Lt. & Pwr...	5s	1945	99½	98½	100
San Joaquin Lt. & Pwr...	6s	1950	102½	103	104½
San Joaquin Lt. & Pwr...	6s	1952	102½	99½	103½
San Joaquin Lt. & Pwr...	6s	1954	101½	100½	102½
Sauda Falls.....	5s	1955	*k* 95½	93½	96
Savannah Elec. & Pwr....	7½s	1941	*k*104½	....	....
Saxon Pub. Wks. (Germany).....	7s	1945	*k* 95½	....	....
Scranton Electric.....	5s	1937	101½	101½	102½
Seattle Elec.....	5s	1930	101½	100½	101½
Seattle Elec.....	5s	1929	99½	99½	100½
Seattle Elec.....	5s	1939	93½	92½	94½
Seattle Ltg.....	5s	1949	92	90½	94
Shawinigan Wtr. & Pwr..	5s	1934	100½	100	101½
Shawinigan Wtr. & Pwr..	5½s	1950	104	103½	104½
Shawinigan Wtr. & Pwr..	6s	1950	104½	104½	105½
Sheboygan Elec.....	5s	1946	95½	94½	96½
Siemens & Halske.....	7s	1928	*k* 99	96	100
Siemens & Halske.....	7s	1935	*k* 97½	93	98
Sierra & San Fran. Pwr...	5s	1949	*k* 75	....	....
Sierra & San Fran. Pwr....	6s	1949	*k* 89	....	....
Sioux City Gas & Elec....	6s	1947	102	101½	102½
Sioux City Gas & Elec....	6s	1949	102½	102	103½
So. Caro. Gas & Elec.....	6s	1942	78	78	83
So. Caro. Gas & Elec.....	6s	1932	65	70	75
Southeast Pwr. & Lt. (ex-warranto).....	6s	2025	*k* 93½	89	94
So. Cal. Edison.....	5s	1939	*k*100½	....	....
So. Cal. Edison.....	5s	1944	98½	98	99½
So. Cal. Edison.....	5½s	1944	104½	103	104½
So. Cal. Edison.....	6s	1943	103	102	104
So. Cal. Edison.....	6s	1944	*k*104½	....	....
So. Cities Utilities.....	8s	1931	99	99	102
Southern Colo. Power....	6s	1947	98½	97½	99½
So. Ind. Gas & Elec.....	6s	1947	*k* 97	....	....
Southern Pwr.....	5s	1930	100½	100	101
So. Public Utilities.....	5s	1943	100½	100	101½
So. Sierras Pwr.....	6s	1936	*k*103½	....	....
So. Utilities.....	6s	1933 *m*	102	*n* 97½	*n*102½
So. Wisconsin Pwr.....	5s	1938	92½	91	93
Southwestern Gas & E....	5s	1932	96	97	98½
Southwestern Gas & E....	6s	1957	97½	97½	99½
Southwestern Lt. & Pwr..	6s	1937	98	98	99½
Southwestern Power.....	6s	1944	96½	96½	98
Southwestern Pwr. & Lt..	5s	1943	95½	94	96
Southwestern Pwr. & Lt..	6s	2022	94	94	96
Southwestern Pub. Serv..	6s	1945	97	94	96
Southwestern Utilities....	8s	1936	95	92½	96
Springfield Ry. & Lt.....	5s	1926	99½	99½	100½
Standard Elec. of Cal....	5s	1939	100	99½	101
Standard Gas & Elec.....	6s	1935	*k* 99½	....	....
Staten Island Edison.....	6½s	1953	105½	106	107½
Superior Water, Lt. & Pwr.	4s	1931	94½	94½	95½
Syracuse Ltg.....	5s	1951	101	100	100½
Syracuse Ltg.....	5½s	1954	104	103½	104½
TAMPA ELEC.....	5s	1933	*k* 99	....	....
Tenn. Elec. Pwr.....	6s	1947	*k*105½	....	....
Tenn. Pwr.....	5s	1962	96½	96	97
Tex. Pwr. & Lt.....	5s	1937	98½	98½	100
Tex. Pwr. & Lt.....	6s	2022	97½	95½	97
Tide Water Pwr.....	6s	1942	101½	100	101½
Tide Water Pwr.....	7s	1937	106	100	107
Toho Elec. Pwr. (Japan)	7s	1955	*k* 91½	....	....
Tokyo Elec. (Japan).....	6s	1928	*k* 98	....	....
Toledo Edison.....	5s	1947	100	100	100½
Toledo Edison.....	7s	1941	*k*108½	....	....
Toledo Gas, Elec. & Htg.	5s	1935	100½	98	100½
Toledo Tr., L.&P. (notes)	5½s	1930	98½	98	99½
Topeka Edison.....	5s	1930	99	99	100
Topeka Ry. & Lt.....	5s	1933	94½	94½	96½
Trenton Gas & Elec.....	5s	1949	101½	100½	101
Tri-City Ry. & Lt.....	5s	1930 *m*	98½	....	....
Twin State Gas & Elec...	5s	1953	95½	95	96½
Twin State Gas & Elec...	5½s	1945	98½	98	99
Tyrol Hydro-Elec. Pwr...	7½s	1955	96	95½	97½
UJIGAWA ELEC PWR.	7s	1945	91½	92	94
Union Elec. Lt. & Pwr...	5s	1932	101	101½	101½
Union Elec. Lt. & Pwr...	5s	1933	101½	101½	101½
Union Elec. Lt. & Pwr...	5s	1954	99	99½	101
Union Elec. Lt. & Pwr...	5½s	1954	100½	100½	102½
United Elec. of N.J.....	4s	1949	88	87½	89
United Elec. Lt. & Pwr...	4½s	1929	98	98	99½
United Gas & Elec.....	6s	1945 *m*	101½	*n* 96	*n*101
United Lt. & Pwr. (notes)	5½s	1928	99½	99	100½
United Lt. & Pwr.....	5½s	1959	95½	96	97½
United Lt. & Pwr.....	6½s	1974	96	95½	98½
United Lt. & Rys.....	5s	1932	96	96	97½
United Lt. & Rys.....	6s	1926	99½	100	101½
United Lt. & Rys.....	6s	1952	100½	99	101½
United Lt. & Rys.....	6s	1973	89	89½	92
United Pwr. & Lt.....	6s	1944	102	102	103½
United Water, G. & E....	5s	1941	94½	94	95
Utah Lt. & Trac.....	5s	1944	*k* 89½	....	....
Utah Pwr. & Lt.....	5s	1944	97½	95	97
Utah Pwr. & Lt.....	6s	1944	103	102½	104½
Utah Pwr. & Lt.....	6s	2022	92½	88½	94½
Utica Elec. Lt. & Pwr....	5s	1950	103½	100½	102½
Utica Gas & Elec.....	5s	1957	102½	100½	102½
Utica Gas & Elec.....	5½s	1949	104	103½	104½
VERMONT HYDRO-ELEC....	6s	1929	100	100	101
Vicksburg Lt. & Trac....	5s	1932	94	93½	93½
Virginian Pwr.....	5s	1942	98½	88	99
Virginian Pwr.....	6½s	1954 *m*	103½	103	104½
Virginia Ry. & Pwr.....	5s	1943	99	97½	99
Virginia Western Pwr....	6s	1953	105	101½	106½
WAGNER EL. MFG....	7s	.... *m*	100½	100½	101½
Washington Coast Util...	6s	1941	102	102½	103½
Washington Ry. & Elec...	4s	1951 *m*	81½	....	....
Washington Ry. & Elec...	6s	1933 *m*	102½	....	....
Washington Wtr. Pwr....	5s	1939	101½	101½	102½
West Penn Pwr.....	5s	1963	102	99½	102
West Penn Pwr.....	5s	1946	101½	99½	102
West Penn Pwr.....	5½s	1953	105½	104½	106
West Penn Pwr.....	7s	1946	106½	105½	108½
W. Va. Lt., Ht. & Pwr....	6s	1929	101	101	102
West Virginia Utilities....	6s	1935	97½	95½	97½
W. Va. Water & Elec.....	6½s	1942 *m*	103½	102½	104
Westchester Ltg.....	5s	1950	103	102½	103½
Western Elec.....	5s	1944	*k*102½	....	....
Western N. Y. Utilities...	5s	1946	97	96½	98
Western Pwr.....	6½s	1954	100	100	102
Western Pub. Service....	6s	1950	98	98	99½
West States Gas & Elec..	5s	1941	99½	98½	99½
West States G.&E. (notes)	6s	1937	94½	94½	96
West States Gas & Elec..	6s	1947	*k* 99	....	....
West United Gas & El....	5s	1950	102	101½	102½
West United Gas & El....	6s	1950 *m*	102	*n*100	*n*102
Westphalia Un. Elec. Pwr	6½s	1950 *m*	98½	....	....
Westinghouse El. & Mfg.	7s	1931	*k*106½	....	....
Wheeling Elec.....	5s	1941	98½	99	100
Wichita R. R. & Lt.....	5s	1932	85½	83	88
Winnipeg Elec.....	6s	1954	95½	96	97½
Wisconsin Elec. Pwr.....	5s	1954	98½	98½	99½
Wisconsin Gas & Elec....	5s	1952	*k* 99½	....	....
Wis.-Minn. Lt. & Pwr....	5s	1944	*k* 97	92	94½
Wisconsin Pwr., Lt. & Ht	5s	1946	93½	101	102½
Wisconsin Pub. Service...	6s	1952	101½	94½	96½
Wis. Ry., Lt. & Pwr.....	5s	1933	95½	92½	94
Wis. River Pwr.....	5s	1941	93½	92½	94
Wolverine Pwr.....	7s	1943	101½	100	101½
YADKIN RIVER PR..	5s	1941	*k*100	....	....
Yarmouth Lt. & Pwr.....	5s	1937	83	83	87
Yarmouth Lt. & Pwr.....	8s	1951	102	99	102

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Tuesday, April 20. *l*Bid, low, high, Wednesday, April 21. *m*Latest quotations available. *n*1925.

Manufacturing and Markets

Program of Simplification for Carbon Brushes

Recommendation of Power Club to Become Effective Nov. 1—Further Studies to Be Made by a Committee

REPRESENTATIVES of electrical apparatus manufacturers, carbon-brush manufacturers, government and private consuming interests and others, meeting Wednesday, April 14, at the Department of Commerce, Washington, adopted a program which, it is expected, will make a material reduction in the number of varieties and sizes of carbon brushes and brush shunts for electrical equipment. The program of simplification adopted was developed by the Electric Power Club through a committee on standardization and was presented by S. N. Clarkson of that organization. The only change made was in the two smallest sizes of brush shunts which call for strands of two-mil wire, which was said to cost five or six times as much as three-mil wire. It was, therefore, decided to recommend that these small sizes of brush shunt cable be made of three-mil wire with a cross-section of 300 circ.mils and 600 circ.mils.

The program as recommended by the Power Club appeared in the April 10 issue of the ELECTRICAL WORLD. E. W. Ely of the Division of Simplified Practice of the Department of Commerce presided at the meeting.

IMPORTANT SUGGESTIONS RECEIVED

Discussions of the program revealed that there are literally thousands of sizes to stock, which ties up considerable sums. Several speakers declared that it will be possible eventually to reduce considerably the variety. The simplification program will become effective on Nov. 1, 1926, for a year. Further studies of possible reductions will be developed by a standing committee of the industry, representing the Electric Power Club, the carbon-brush manufacturers, distributors and users. Along this line a number of important suggestions were received for further technical study by a standing committee to be appointed by the chairman of the meeting.

The attendance was as follows: Alexander Maxwell, National Electric Light Association and representative of the American Engineering Standards Committee; A. Cressy Norrison, National Carbon Company; L. A. Heath, Morganite Brush Company; S. N. Clarkson, Electric Power Club; T. S. Rader, E. A. Williford and J. F. Kerlin, National Carbon Company; B. E. Huggins and William H. Hardman, General Electric Company; R. A. Frye, Westinghouse Electric & Manufacturing Company, and Dean Harvey, representing the Westinghouse company and the American Institute of Electrical Engineers; H. C. Montgomery, Boxill Bruel Carbon Company; H. H. Erdman, Stackpole Carbon Company; R. H. Dalgleish, representing the American Electric Railway Association; Lieutenant-Commander G. H. Wood, W. C. Dean and W. G. Hill of the Navy Department; William J. Garnett of the office of the chief of engineers of the army; A. S. McAllister, United States Bureau of Standards, and R. A. Lundquist and H. E. Way of the electrical division of the Bureau of Foreign and Domestic Commerce.

American Industry and Public Policy

First in a Series of Articles Discussing Relationships and Responsibilities of Industry to Certain Economic, Political and Social Considerations

BY JAMES A. EMERY
General Counsel National Association of Manufacturers

THE lifetime of the United States measures the origin and development of what we term "industrial civilization." Within a century the characteristic simple, independent, agricultural society of the Napoleonic era has been transformed into a complex interdependent industrial civilization. Its material security rests upon the continuity, efficiency and development of its economic system. This, in turn, is more profoundly influenced than ever before by the course of government toward the human agencies and instrumentalities of business.

Substantially coincident with what is commonly described as "the industrial revolution" occurred the American political revolution. Its philosophy energized human effort more powerfully than steam stirred mechanism. It gave a new direction to human purpose, new hope to the heart, new opportunity to the multitude, new security to the fruit of individual achievement. Under its driving force the little handful of agricultural colonies scattered along the wild Atlantic seaboard have become politically the most powerful and influential of nations and economically the largest wealth producer and the most comfortably living of human societies. Today the mass of Americans enjoy more convenience, comfort and luxury at a cheaper price than was ever before within the possession of a single people. To conserve, promote and perpetuate these advantages is at once a private and a public purpose.

The problems of the direction of our industrial affairs are not merely technical or economic. They are political and social. For, however difficult in themselves, industrial production and distribution must be carried forward in a constantly changing political medium. All the delicate human adjustments involved are constantly being translated from the business field in which they arise to a political field which may offer a very different answer. To an ever-increasing extent the business of local and national government has become the government of business. Never before was the attitude and intervention of public authority of such vital significance not merely to the directors of production and distribution but to their shareholders and the public.

PURPOSES OF A PEOPLE

It must be obvious that reasonable stability in public policy is an indispensable condition for investment and development. Nor is public policy to be confused with legislation, however important that may be. The former is the major premise of which the latter is but the minor. Public policy should express the more permanent course which government intends to pursue as distinguished from the temporary methods by which it may seek to accomplish its ends. Thus the United States may own and operate a merchant marine, although its objective is private ownership and control. The recognition or non-recognition of a particular régime in Mexico or Russia may mean commercial loss or gain to the business of the day, but far more important is the determination by the United States that it will recognize no form of government which refuses to meet international obligations, assure the sanctity of contracts and the safety of life and property. No form of railroad regulation can be so important as the settled determination that our transportation service must be adequate, uninterrupted and efficiently operated at reasonable cost to the shipper and with a fair return to the carrier.

Indeed, until public policy is clearly and permanently defined with respect to any important subject its expression in legislation is correspondingly ambiguous and unstable. The uncertain restrictions of the anti-trust acts will never be clarified until we determine whether as a matter of public policy the common welfare is best served by always compelling competition or recognizing and regulating beneficial co-operation. How shall we improve our taxing system without first deciding whether its primary purpose is to raise revenue or redistribute wealth?

Nor is the need of stable public policy confined to our domestic affairs. After five years of flux, the Dawes plan substitutes a permanent basis of economic relationship between the European states for the shifting political policies

of changing ministries, and is not less potent in its influences upon American trade relations.

RESPONSIBILITY FOR PUBLIC POLICIES

So the slightest reflection upon our history and immediate experience but serves to emphasize the critical relation of governmental policy to private tasks. Our commercial history since the Civil War, and particularly from the beginning of the present century, is one of halting hesitation on the eve of dubious elections threatening serious political change. Yet American industry, in management, investor and worker, represents the co-operation of the most amazing wealth producer and civilization server any people have ever possessed. But its progress necessitates not only sound but stable policy. That is the indispensable condition for the progressive development and application of the fruits of research and invention through the aid of expanding investment and permanent employment. These conditions are assured only through clear and definite understanding of the relations of government to our economic operation, so that the future may be faced with increasing certainty. We need, therefore, not tax legislation but a policy of taxation, not agricultural legislation but a policy toward agriculture, not hundreds of transportation proposals but a transportation policy, not a flock of schemes to regulate associated effort but a clear-cut policy for business co-operation.

BUSINESS MEN SHOULD AID

A popular government cannot operate itself. It merely affords instrumentalities through which the intelligence of the electorate must operate. For the manufacturer, the engineer, the merchant, the railroad executive or the farmer must not leave to the politician the solution either of the special or the general problems of each industry or the nation. But each in its own sphere must undertake to meet its own, to arrive at self-government in its own industry and co-operate with its fellows at all points of contact, that they may arrive at a larger voluntary control over themselves which will stand in all particulars the test of the public interest. This points a way, through experience and common sense, to establish a common law for each industry. It offers a practical means of self-correction which ought to make a persuasive appeal to the critical public.

Our ideals and our experience alike urge that business men, individually and collectively, shall take an active interest in shaping public policy, both as a political duty and a business necessity. To take the same interest in the qualifications of a political agent that one takes in the selection of a sales agent is the plain counsel of good sense. To make available for authority-formulating policy the special knowledge and experience of an individual or an industry is a sound commercial counsel as well as a political obligation. To set up in each industry the practice of imposing intelligent self-restraint in business conduct is to establish the kind of practical self-government which is the very essence of the American system and which, fairly practiced, tends to reduce the excuse for political intervention to a minimum.

Electric Industrial Trucks and Tractors

The number of electric industrial trucks and tractors shipped during March, 1926, by the eight leading manufacturers in the industry has been announced by the Department of Commerce. The table also shows the figures for each quarter of 1925 and for each of the past six months.

SHIPMENTS OF ELECTRIC INDUSTRIAL TRUCKS AND TRACTORS

1925 Quarter ended:	Domestic — Tractors	Domestic — All Other Types	Exports
March 31	42	251	41
June 30	49	277	50
Sept. 30	56	283	12
Dec. 31	39	293	24
Total	186	1,104	127
October	16	107	5
November	11	101	9
December	12	85	10
1926			
January	18	86	3
February	15	93	5
March	11	124	8
Total (three months)	44	303	16

Bearings for Refrigerator Motors

Refrigerator Manufacturers Overwhelmingly Favor the Wool-Packed Bearing for the Domestic Machine—Many Reasons Cited to Explain Preference

OWING to the difference of opinion existing in the industry as to the type of bearing best adapted for fractional-horsepower motors used in operating the domestic electric refrigerator, the ELECTRICAL WORLD asked the manufacturers of domestic electric refrigerators what type of bearing they were using and the reason for their choice. These manufacturers were also asked whether from their experience they preferred any other type of bearing to the one they were using and whether their reason for not actually employing the preferred type was higher cost or some other unfavorable factor. The motor manufacturers were also asked for information as to the type of lubrication that they were using on repulsion induction motors furnished to the refrigerator manufacturers.

Basing the conclusion on the number of units manufactured and not on the number of manufacturers, makers of refrigerators overwhelmingly prefer the motor equipped with wool-packed type of bearing. A large manufacturer says: "The type of bearing and lubrication which we feel must fulfill the requirements for household refrigeration should have the following characteristics: First, it should be quiet in operation; second, it should run for longer periods of time without additional oiling; third, it should not allow oil to be transmitted to other parts of the motor, such as commutator, brushes and windings; fourth, it should not allow oil to be spilled in handling or shipping; fifth, it should not require special oil in order to operate satisfactorily; sixth, it should not allow dirt to get into the bearings; seventh, it should provde sufficient oil to the shaft for a reasonable variation in speed and load, and, eighth, it should be lubricated satisfactorily at low temperatures. We believe the wool-packed bearing is the most satisfactory type of lubrication we have seen for household refrigerating machines, and it is a bearing which will operate satisfactorily under the many different conditions in which our refrigerator is called upon to function."

Another manufacturer says: "The question of bearings is one of the most vital to the life of the small motor, especially where it is adapted for household purposes and for other places where a limited amount of attention is given to the lubrication of the apparatus. Many washing-machine motors are equipped with a wick-type bearing which has proved satisfactory for such service, but such a motor operates approximately 150 hours per year as compared with 150 days continuous running in the case of the refrigerator motor.

"We are using a motor with a wool-packed bearing on our refrigerating machine and believe it to be the best type for the following reasons: A larger storage of oil may be obtained; the contact of the wool with the shaft is better than that of a wick feeding up through a small hole; on the wick-type bearings there sometimes is a tendency to burnish over the end of the wick, causing the flow of oil to stop and the shaft to cut, whereas to our knowledge this has never occurred in the wool-packed bearing, and our fourth reason is because the companies making small motors should be in a better position than any one else to know what results can be obtained from the different types of bearings. A number of motor manufacturers who have apparently done considerable experimental work along these lines, and who are making a high quality motor, have adapted the wool-packed bearing and claim from a life standpoint in actual tests that they have obtained a much longer lubricating life.

"We have had practically no experience with the ball bearing or oil-ring types of bearings. We consider the oil-ring type of bearing to be objectionable from the standpoint that the motor cannot be shipped with the lubricant, which must be placed in the motor after it is in the field. It is also objectionable from the noise standpoint as the rings frequently rattle."

Another refrigerator manufacturer says: "It has been our experience that the wool-packed bearing gives us the best satisfaction in the field. The ball

bearing is too noisy, the oil-ring type is too unreliable owing to the fact that the oil wells usually leak, and the wick type has the disadvantage of sometimes cutting the shaft. The wool-packed bearing, we find, can be run for a year or more without the addition of oil, and as our experience indicates that customers do not oil their equipment, this appeals to us as of the greatest value."

And yet another manufacturer says: "Our experience in the past has shown that the wool-packed bearing is far superior to the ring oil bearing, and we have found that the latter has a tendency to throw oil out of the bearing by centrifugal force should the motor not be properly level. The ball-bearing type has a tendency to produce a humming sound, and where sulphur dioxide is used as a refrigerant the least bit of escaping gas will attack the ball bearing."

The motor manufacturers are now offering motors equipped with the following types of lubrication:

A. The waste-packed system of lubrication. This system is also used by one company in its standard repulsion induction direct-current and three-phase motors of ½ hp. and larger in the fractional sizes.

B. Oil-cup wick lubrication.

C. Wool-packed bearing.

D. Wool wick operating in oil.

E. Waste-packed type and also some of the oil-ring type having large reservoirs, which in some cases are piped to the lubricating system of the refrigerating machine. There is little or no demand for ball-bearing construction.

F. Ball bearing.

Business Conditions

SALES during April are so far less than those made to date last month, but they are better than in the corresponding period last year. Central-station companies have become more active, and there are an increasing number of inquiries in the market, many covering transformers, transmission-line material and high-tension control and switching apparatus. Holding companies operating in Florida, Missouri and Ohio have been especially active. Industrial buying has been prominent in the Southeast, and a number of new projects are under way in the northern section of the Pacific Coast, including a lumber mill, a cement plant, a pulp and paper mill and the immediate electrification of several shingle mills.

In New England an uneven tone marks sales, but this is offset by an increasing number of inquiries. Transmission-line projects are active and there is a demand for control and switch apparatus. Industrial electric heating equipment is in active demand, a toolmaker buying a 75-kw. furnace and a Connecticut brass manufacturer placing an order for two 330-kw. annealing furnaces. Central-station companies are buying actively in the New York district. Pole-line hardware is in active demand and small motors are selling well. In the Southeast some very satisfactory industrial jobs have been closed. Central-station companies are active, and a large volume of orders has been placed for poles, pole-line hardware and transmission-line conductors. Conditions have created an optimistic outlook in the Middle West, and the various utility companies are busy with construction work. On the Pacific Coast inquiries for poles have predominated. Several large industrial projects are reported in the northern section.

Non-Ferrous Metal Prices Decline Further—Lead Sales Active

Many of the non-ferrous metals have reached new low levels. Lead is the only metal in which the volume of sales during the week has been well maintained, though the low prices asked for tin on Tuesday attracted a good day's business and zinc sales have been spasmodically good. The weakness seems to have had its origin in London, the lower prices affecting buying in the United States. On Thursday, Friday and Saturday last week copper was sold in fair volume at 14 cents, delivered in the East. On Monday, however, with lower prices reported from London, no consumers could be interested at those levels, and even an offer at 13.95 cents met no response. On Tuesday a limited number of sellers quoted 13⅞ cents, at which price small sales were made. On Wednesday business has been booked, in a small way, at 13.85 cents, delivered in the East. Most sellers have not met these lower prices, but there seems to be plenty of the metal available to take care of the very limited demand.

The American Smelting & Refining Company on Monday, April 19, reduced its official contract price for New York lead from 8 cents to 7.85 cents. On Tuesday and Wednesday large sales for late May and early June delivery were made at 7.75 cents, New York. The St. Louis market kept in close step with New York. The volume of business, particularly in New York but also in St. Louis and Chicago, has been good, both before the smelting company reduced its price as well as on the three days of the current week. Most of the zinc has been sold rather than bought during the last week, producers finding that tempting bait was necessary to find a market for their product. After easing gradually since last Wednesday, spot Straits reached 62½ cents per pound on Tuesday. On the break consumers entered the market, and in the afternoon good sales were made at 62.625 cents.

NEW YORK METAL MARKET PRICES

	April 14, 1926 Cents per Pound	April 21, 1926 Cents per Pound
Copper, electrolytic	13.95–14⅛	13.85
Lead, Am. S. & R. price	8	7.85
Antimony	17¼	17¼
Nickel, ingot	35	35
Zinc, spot	7⅛	7.30
Tin, Straits	64	62.875
Aluminum, 99 per cent	28	28

Base copper price April 21, 1926, 16½ cents

Pole Inquiries Predominate on the Pacific Coast

Pole inquiries have predominated in the business on the Pacific Coast. The central California towns of Roseville Bay, Point Novato and Mountain View are all in the market for from one to three carloads of 7-in. and 8-in. sizes. A central-station company is also in the market for approximately $150,000 worth of poles, probably representing three years' normal stock. Tool inquiries are in large volume from power companies, and some interesting orders were placed. Export orders have included 50 miles of telephone-line equipment and 125 miles of No. 10 bare copper wire for the Philippines. Telephone material also has largely predominated in recent railroad purchasing. Power-company buying has included clay ducts, creosote oil, insulators and other items.

Several interesting industrial projects are reported in the northern section of the Pacific Coast, and some orders for equipment have already been placed. A contract for about $25,000 worth of motors and control equipment has been awarded by a lumber company for its new mill. Inquiries have been received for an installation comprising 84 motors, and inquiries for quotations on the electrical equipment for a two-million-dollar cement plant to be built in Everett have also been sent to manufacturers. A pulp and paper mill to cost about $1,500,000 will soon be installed in the Grays Harbor district. The city of Seattle will purchase 20 induction voltage regulators costing about $30,000, outdoor switching equipment, and a considerable amount of cable early in May, and the city of Everett plans the installations of a street-lighting system costing about $40,000. Several shingle mills in the Puget Sound district will shortly be electrified, each requiring about 200 hp. in motors, and scattering orders have been placed for motors for Alaskan mines.

Uneven Tone Marks Sales in New England District

The decline in the trend of buying electrical equipment during the past week, as reported by a number of manufacturers in the New England district, is offset in great part by the increasing number of inquiries received. Reports from Maine indicate much activity in transmission-line projects; a manufacturer states that there is a growing interest in motors for replacement in factories, and another records a considerable demand for control and switch apparatus, with municipalities particularly interested in replenishing stocks for the coming season. Small motors are selling well, and industrial electric heating equipment is in active demand. A 75-kw. furnace was purchased by a toolmaker, and a prominent Connecticut brass manufacturer recently purchased two 330-kw. annealing furnaces and will probably add another in the near future. Wire and cable sales are active.

Household appliance sales are spotty, but refrigeration activities are strong. Small portable electric driven contractor's tool are selling well and ac-

cording to one manufacturer are to date far ahead in volume as compared with a corresponding period last year. Commenting on the jobbing situation, a well-known manufacturer's agent records little slump, as compared with other years, during the past few weeks. On the other hand, with the industrial situation now showing a favorable turn in most lines and a very strong boom in new building in prospect throughout this district, much encouragement is in view for the electrical trade.

Conditions in Middle West Create Optimistic Outlook

Evidence of prosperity is noted from various sources in the Middle West. Reports of building work show that a tremendous amount of construction contracts have been let. Reports emanating from agricultural implement manufacturers and carriers give a decidedly optimistic outlook. The various utility companies are busy with construction work and extensions of distribution lines. Buying is on a conservative basis, although considerable quantities of cable, recording meters, pole-line hardware, etc., have been purchased. The demand for maintenance material has been quite extensive and has helped materially to increase the volume of business. Jobbers report good sales. The steady building work has resulted in increased sales of roughing-in material, etc., while appliance sales remain generally good. Electric refrigeration sales are encouraging, and there is a normal demand for motors.

Good Industrial Buying in Southeast—Utilities Active

Business generally continues good in the Southeast, with optimistic reports for activities throughout the spring and summer. Local jobbers report closing several very satisfactory industrial jobs during the past week, and other industrial business is in immediate prospect. Activities among central-station companies throughout the territory are at a high pitch and a large volume of orders is being received for poles, pole-line hardware and conductors, both copper and aluminum. Announcement is made of the construction of a transmission line from Tallahassee, Fla., through Valdosta to Waycross, Ga., which when complete will serve 22 south Georgia towns. Another proposed line will extend from Albany, Ga., through Dawson to Cuthbert and Montezuma, a distance of approximately 40 miles. The central-station expansion program is also causing considerable activity in the 2,300-volt distribution-line material, transformers and house-type watt-hour meters.

The general activities of central-station companies are also reflected in the volume of appliance sales, which are being confined largely to the central-station class of retailer, the local dealers apparently not being very active. Appliance campaigns are being conducted during the spring months by many large power companies in the section. A large electric appliance manufacturer reports that his company's sales in this territory for the first quarter of 1926 are about 300 per cent in excess of the same period last year. Florida is producing a good volume of orders for power transformers and heavy oil-switch equipment used in connection with the construction of transmission lines over the state generally. Several very satisfactory orders for storage-battery equipment, some of which is for operation of substation oil switches, were reported last week, with expectations for a duplication of these orders within the current month. "White-way" orders continue in good volume but the individual orders are not large.

Central-Station Companies Buying Actively in New York District

Central-station companies are buying actively in the New York district. Some manufacturers' reports indicate that sales this month are below the volume for the same period in March, but they are greater than for the corresponding period last year. Transformers are particularly in demand. One order calling for about $60,000 worth of transformers is expected to be closed this week. One manufacturer states that his sales for this year are greatly in excess of those last year, and the volume of inquiries being received indicates that this condition will probably continue. The demand for control apparatus and insulators is not so heavy as it was earlier in the year, but there is a fair market for these lines, and an improvement is expected in the near future. Pole-line hardware is in active demand among both central-station companies and industrial buyers, one manufacturer's sales for three months of this year exceeding his expectations by about 35 per cent. Switchboard instruments also are moving rapidly. In the industrial field control apparatus and motors of the larger sizes are rather dull, although the demand for small motors continues strong. Jobbers are still experiencing a period of inactivity in all their lines.

Activities of the Trade

Federal Electric Celebrates Twenty-fifth Anniversary

The Federal Electric Company, 8700 South State Street, Chicago, manufacturer of electric signs, household appliances and specialties, completed twenty-five years in the electrical industry on March 25. The founders of the business, John F. Gilchrist and James M. Gilchrist, were guests of honor on that night at a dinner given at the Hotel La Salle by P. D. Rensenhouse, secretary and treasurer of the company. The dinner was attended by the directors and principal people of the company and its subsidiaries. Talks were given by Martin J. Insull, president of the Middle West Utilities Company, and Edward W. Lloyd, vice-president of the Commonwealth Edison Company, both of whom are directors of the company. Diamond-set service badges were presented to the Messrs. Gilchrist.

Westinghouse Sales Estimated to Show Large Increase

Sales of the Westinghouse Electric & Manufacturing Company for the fiscal year ended March 31 are estimated to be about $180,000,000, an increase of approximately 20 per cent over the previous year. Billings for the year are estimated at $167,000,000, which compares with $157,880,292 for the preceding year, a gain of about 6 per cent. Billings for the quarter ended March 31 last are estimated at $45,000,000. Billings for the nine months ended Dec. 31, 1925, and already announced by the company, were $122,253,533.

National Carbon Company Opens New Plant at Birmingham

A new brush-finishing plant has been recently opened by the National Carbon Company, Inc., at Birmingham, Ala. This new plant, which is the seventh of its kind now operated by the company, will be devoted to the manufacture and distribution of all types of industrial brushes throughout Southern territory, which in past years has been served by the Cleveland plant. The other plants are located at New York, Pittsburgh, Chicago, Toronto, Cleveland and San Francisco.

The plant occupies a new brick building especially constructed for the purpose at Ninth Avenue and Nineteenth Street. It has 3,000 sq.ft. of floor space and a potential capacity of 60,000 brushes per month. J. A. Hammond is in charge of the sales division of the new plant, J. B. Collins has charge of the carbon sales division and J. W. Suter is factory superintendent.

General Electric Company Receives Large Turbine Order

A 90,000-kw. cross-compound turbine to be added to the equipment of the Crawford Avenue station of the Commonwealth Edison Company of Chicago is being manufactured by the General Electric Company. The turbine will consist of two sections, a high-pressure element of 35,000-kw. capacity running at 1,800 r.p.m. and a low-pressure element of 55,000-kw. capacity operating at 1,200 r.p.m. A 2,000-kw. service generator will be connected to the high-pressure element and a 500-kw. direct-connected exciter to the low-pressure element.

Operating conditions will be the same as for the other units in the station, with steam at 550 lb. gage and 760 deg. F. total temperature. The unit will be 13 ft. 6 in. high. The length of the high-pressure element will be 71 ft. and that of the low-pressure element 53 ft. The total weight of the unit will be 1,978,000 lb.

The Roach Appleton Manufacturing Company, 3982 Barry Avenue, Chicago, manufacturer of switch boxes, ground clamps, etc., announces the appointment of George A. Kieffer, 141 Fremont Street, San Francisco, and the Wesco Company, Seventh and Lawrence

Streets, Denver, as its sales agents. The company also states that Walter G. Michel, 312 Omar Avenue, Los Angeles, who is also a representative of the company in the Far West, carries a liberal warehouse stock of its products.

Pacific Gas & Electric Lets Contract for Melones Plant

The Pacific Gas & Electric Company recently let contracts covering equipment for its Melones plant. The S. Morgan Smith Company, York, Pa., is furnishing two reaction turbines, 18,000 hp. each, to operate at 277 r.p.m. under a variable head of 125 ft. to 200 ft., complete with oil-pressure system and relief valves for 100 per cent discharge duty. The Pelton Water Wheel Company, San Francisco, was awarded the contract for two penstock and one intake valve, all of the butterfly type, and the Westinghouse Electric & Manufacturing Company received the contract for electrical equipment consisting of two 13,500-kva., 6,600-volt generators with direct-connected exciters and four 9,000-kva., single-phase, water-cooled, shell-type transformers, 6,600 volts to 115,000 volts.

The Servel Corporation, 51 East Forty-second Street, New York, manufacturer of electric refrigerators, at a recent special meeting of stockholders at Richmond, Va., unanimously approved a new plan of recapitalization, details of which appeared in the March 20 issue of the ELECTRICAL WORLD. The plans call for a recapitalization of the company under a Delaware charter and the issuing of only one class of stock.

The Edison Electric Appliance Company, Inc., 5600 W. Taylor Street, Chicago, has recently placed on the market the model R-95 "Hotpoint" range, a three-unit low-priced cabinet range to sell for around $100. The company states that this unit has the same electrical standards as its other ranges.

The Cutter Electrical & Manufacturing Company, Nineteenth and Hamilton Streets, Philadelphia, manufacturer of circuit breakers, announces that on or about May 1 its New York office will move from 1170 Broadway to 12 East Forty-first Street.

The Hart-Parr Company, Charles City, Iowa, manufacturer of the Hart-Parr vacuum electric clothes washer, announces that Shafer Greenburg has been appointed district manager for the New England district. For the past several years Mr. Greenburg has traveled in New England for Landers, Frary & Clark. The company also announces the appointment of A. O. Ruste as its Pacific Coast representative.

The Mutual Electric & Machine Company, 7610 Joseph Campau Avenue, Detroit, announces that it has placed on the market a combined switch and cutout known as the "Bull Dog SaftoFuse" in 30-amp. and 60-amp. capacities at 250 volts. The fuses are mounted on a composition base or fuse carrier with switch contacts. The fuse carrier must be withdrawn from the receptacle base before the fuses are accessible.

The Railway & Industrial Engineering Company, Greensburg, Pa., manufacturer of transmission, switching and protective equipment, announces that the new address of its agents in Rochester, N. Y., the Schiefer Electric Company, is the Gas & Electric Building, 89 East Avenue. The company has just completed negotiations for the construction and equipment of a 132-25-kv. substation for the West Penn Power Company. This station, at Butler, Pa., will supply the power for the Forged Steel Wheel Company direct from the West Penn lines at Springdale.

The Westinghouse Electric & Manufacturing Company has prepared plans for the expansion of its works at East Springfield, Mass. The improvements, completion of which is planned for next September, include the erection of a new three-story administration building 300 ft. by 54 ft., a four-story addition to the main factory building, 110 ft. by 80 ft., a new brick building in the rear of the machine shop for the machining and storing of castings, remodeling of the dry kiln building and enlargement of the punch press shop, as well as the remodeling of the present office building to provide quarters for the exclusive use of the office staff of the fan division.

The Graybar Electric Company, 100 East Forty-second Street, New York, announces the appointment of O. E. Richardson as broadcasting sales engineer, A. J. Eaves as public address and carrier current sales manager, J. W. Skinkle as signaling sales manager, G. E. Chase as broadcasting sales manager, A. S. Wise as appliance sales engineer, G. K. Heyer as assistant general supply sales manager and P. M. Rainey as telephone sales manager.

New Equipment Available

Static Condenser

A new line of static condensers for individual motor application on motor circuits of 220 volts, 440 volts and 550 volts, and for two-phase and three-phase circuits, has been developed by the Westinghouse Electric & Manufacturing Company. The new condenser is completely inclosed in a sheet-metal container. The unit is equipped with a porcelain terminal housing arranged for conduit connections. All live parts are completely covered, thus assuring safety to the operator. The units are available in sizes of ½ kva., 1 kva., 2½ kva. and 5 kva.

Pyrometer Controller

A new pyrometer controller, model 479, which can be used on all temperatures up to 3,000 deg. F., has been developed by the Bristol Company, Waterbury, Conn. The instrument is said to have an extra-wide scale and is motor-driven with a governor that is positive in its operation. The plane of travel for the switch is fixed and is so designed as to be horizontal when installed for operation, and other parts are carefully adjusted with this as a reference plane. The millivoltmeter movement is accurately adjusted so that the pointer swings in a plane absolutely parallel to the plane of motion of the switch. The switch is said to operate with certainty at any part of the scale.

The complete moving mechanism which supports the switch is assembled in one unit, which unit is held rigidly in a large bearing. The controller is provided with a safety adjusting mechanism for setting the position of the index at the point to which it is desired to bring the temperature. A small hinged cover is used to inclose the adjusting knob. This knob cannot be operated until the cover is opened. The act of opening the cover automatically forces the switch mechanism to its lowest position, where it is entirely free from the pointer. Tests on this new controller are said to have shown that a movement of the pointer which is too small to be observed with the naked eye will decide whether contact is made on the high or low side. This extremely close operation is said to eliminate the need for partial or set-back scales.

Drum Controllers

A completely standardized line of drum controllers embodying new features of construction and comprising units for general-purpose, crane-hoist or machine-tool applications, for either direct or alternating current, has been announced by the General Electric Company. In each group several sizes have been provided to cover a wide range in motor ratings, the smaller sizes being suitable for wall mounting and those for larger motors for floor mounting.

A number of distinctive advantages are claimed for the new line. One of the particular features is in the mechanical construction, a skeleton type of frame being used. The switch is thus accessible from both back and front for the purpose of making adjustments, renewals, etc. Another feature, particularly valuable in crane service, is the interchangeability of operating handle mechanisms. A vertical operating lever or a spring-return mechanism may easily be substituted for the horizontal lever with which the switch is equipped by using another dial plate. A new style of self-aligning contact fingers is used. The renewable copper tips are standardized for all switches of the same capacity. Where cross-arcing is likely to occur adequate preventive barriers and blowouts are provided.

Master Switch.—A new lever-operated master switch for steel-mill service or other work where exceptional strength and durability are important factors is announced by the General Electric Company. The new switch is said to be particularly suitable for grouping and for operation by one man. It has been designated as the type C-3003 in the CR-3012 series of control. The switch consists of a cast-iron frame and cover totally inclosing the contact mechanism. The handle of this switch is held in the "off" position by a spring roller device.

New Trade Literature

WATER SOFTENERS.—The Cochrane Corporation, Seventeenth Street and Allegheny Avenue, Philadelphia, is distributing bulletin No. 665, in which it describes and illustrates the "Zeolite" water softeners for use in boiler plants. It contains instructions for determining the proper size of "Zeolite" softener and the best arrangement as to whether a single, double or triple unit should be used; also instructions for calculating hardness to the basis of calcium carbonate and for using the standard soap solution test.

CENTRIFUGAL PUMPS.—The Pennsylvania Pump & Compressor Company, Easton, Pa., has issued bulletin No. 207, describing the Pennsylvania multistage centrifugal pumps, class "OMS," single-suction opposed-impeller type. Illustrations are given showing various applications of the pumps and also a line drawing of a typical cross-section of a three-stage type "OMS" centrifugal pump. Specifications of the pumps are also included.

REFRACTORY GUN.—The Quigley Specialties Company, Inc., 26 Cortlandt Street, New York City, has issued a booklet describing and illustrating the Quigley refractory gun for quick repairs and maintenance of furnace linings, including hot patching and surface coatings.

ELECTRIC SIGNAL DEVICES.—Catalog No. 19 issued by Edwards & Company Inc., 140th and Exterior Streets, New York City, covers that company's complete line of products, including electric signaling devices, bells and buzzers, transformers, fire alarms, burglar alarms, etc. Attention is called to a complete new line of transformers and annunciators.

ELECTRIC RANGES.—Catalog No. 25A issued by the Simplex Electric Heating Company, 85 Sidney Street, Cambridge, Mass., describes and illustrates the complete new line of Simplex electric ranges and the new automatic unit. In this catalog are embodied details of mechanical construction of the Simplex range.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

HUDSON, MASS.—The Firestone-Apsley Rubber Company, subsidiary of the Firestone Tire & Rubber Company, Akron, Ohio, plans to install electric power equipment in the proposed addition to its plant to cost about $225,000.

HARTFORD, CONN. — The Pratt & Whitney Aircraft Corporation, operated by the Pratt & Whitney Manufacturing Company plans to install electric power equipment in its proposed new plant, to cost about $300,000.

THOMASTON, CONN.—The Seth Thomas Clock Company plans to install electric power equipment in connection with proposed extensions to its works to cost $750,000. Additional equipment will be installed in the power plant.

Middle Atlantic States

BOLIVAR, N. Y.—Application has been filed by the Bolivar Richburg Electric Corporation for approval of electric franchises granted by the towns of Alma and Scio.

BROOKLYN, N. Y.—Plans are being considered for the installation of an improved lighting system on Livingston Street.

ELLICOTTVILLE, N. Y.—The Niagara, Lockport & Ontario Power Company, Buffalo, plans extension to its local power plant.

INDEPENDENCE, N. Y. — Application has been filed by the Niagara, Lockport & Ontario Power Company, Buffalo, for approval of an electric franchise granted by the Town Board of Independence.

NEW YORK, N. Y. — The Brooklyn Bridge Freezing & Cold Storage Company, 24-26 Vandewater Street plans to install electric power equipment in connection with additions to its refrigerating and cold storage plant, to cost about $300,000.

ROCHESTER, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until May 12, for replacement of electric wiring at the Rochester State Hospital.

SCHENECTADY, N. Y. — Plans are under way by the Adirondack Power & Light Company for the erection of a new 110,000-volt transmission line from its substation at Rotterdam to the works of the General Electric Company. The capacity of the present line is only 13,000 volts.

MARGATE CITY, N. J.—Bids will be received by the Commissioners of Margate City, City Hall, until April 29 for furnishing materials and installing an underground lighting system on Winchester Avenue from Fredericksburg to Jackson Avenue.

PRINCETON, N. J.—The Borough Lighting Committee has begun work on proposed improvements in the street-lighting system, for which a fund of $11,000 is available.

TRENTON, N. J. — The Board of City Commissioners has authorized extensions and improvements in the municipal fire alarm and police signal system, including underground conduit lines, to cost about $57,000. Oliver M. Schafer, superintendent of electrical bureau, is in charge.

WILDWOOD, N. J. — Steps have been taken by the Wildwood Board of Trade to secure the installation of ornamental lamps on Atlantic Avenue within the city limits, and also on Rio Grande Avenue, between the city limits and the mainland.

CENTERVILLE, PA. — The West Penn Power Company has applied for permission to erect a transmission line over the Monongahela River, between Luzerne Township and Centerville Borough, to be used for service at the plant of the South Fayette Coal Company.

PITTSBURGH, PA. — Plans are being prepared for the installation of a new street-lighting system on North Highland Avenue, between Penn Avenue and Highland Park.

SCOTTSVILLE, VA.—The Central Virginia Power Company, Roanoke, has decided to extend its 44,000-volt transmission line to Scottsville and erect a substation here.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Washington, until May 6, for one motor generator set; two 10 kva. single phase transformers; one 36½ kva. transformer; reflectors, magnet wire, cable, etc. (Panama Circular 1733.)

North Central States

BATTLE CREEK, MICH.—The Postum Cereal Company plans to install electric power equipment in its proposed factory addition, to cost about $350,000. Lockwood, Greene & Company, Buhl Building, Detroit, are architects and engineers.

CINCINNATI, OHIO. — The Western Paper Goods Company, Third and Lock Streets, plans to install electric power equipment in a proposed addition on the Paddock Road, to cost about $300,000.

CLEVELAND, OHIO.—Plans are being considered by the City Council for the installation of an ornamental lighting system on Lorain Avenue as far west as West 117th Street, and an improved lighting system on West Twenty-fifth Street, between Lorain Avenue and Pearl Road, and on Clark Avenue from West Fourteenth Street to West Sixty-fifth Street.

SEBREE, KY.—The General Power & Light Company, Chicago, which has acquired the electric plants at Corydon, Sebree, Slaughters and Calhoun, has purchased a site at Sebree on which it proposes to build a central power station from which it will supply electric service in Onton, Slaughters and Calhoun.

CAIRO, ILL.—The City Council is considering the installation of an ornamental lighting system in the business district consisting of ninety-seven ornamental iron standards, mounted with 400-cp. lamps.

CHICAGO, ILL.—Bids will be received by the Signal Corps Procurement District, Chicago, until May 3, for one automatic telephone switchboard (Circular 23451).

EVANSTON, ILL.—Plans are under way for the installation of a new street-lighting system, consisting of 2,276 lamps of 250 cp., 489 lamps of 400 cp., and 335 lamps of 600 cp., for which bonds have been voted.

QUINCY, ILL.—The Central Illinois Public Service Company, Springfield, has acquired a site on York Street, between Sixth and Seventh Street, and on South Seventh Street, between Kentucky and York Streets, for warehouse and yards. Improvements, to cost about $100,000, are contemplated to the property.

SPRINGFIELD, ILL. — The Illinois Power Company plans to revamp its distribution lines in the northwestern and the western sections of the city. The cost is estimated at $75,000.

SPRINGFIELD, ILL. — The Central Illinois Public Service Company has acquired the municipal electric plant in Brookhart, and the property of the Cambria (Ill.) Light & Power Company. In addition to these properties the company has secured fifty-year franchises in the villages of Clay City and Lima, also ten-year street-lighting contracts in the villages of Murrayville, Clay City and the city of Harrisburg. At Brookport the company plans to abandon the municipal plant which furnished direct current, and to institute a new service.

BELOIT, WIS.—Plans are under way by the Beloit Water, Gas & Electric Company to erect a transmission line from Beloit to Shopiere and Tiffany, a distance of 7 miles, to serve electricity in both towns and to farmers along the route.

ELKHORN, WIS.—The Light & Water Commission plans extensions and improvements in the light and power system, to cost about $16,000.

ALBERT LEA, MINN.—The City Council has contracted with the Interstate Power Company, which furnishes the local service, for the installation of an improved street-lighting system.

BAGLEY, MINN. — The City Council plans to install additional equipment in the municipal electric plant, including a Diesel oil engine-generating unit, switchboard, etc. Earl D. Jackson, 403 Endicott Building, St. Paul, is consulting engineer.

CALEDONIA, MINN. — Bonds to the amount of $18,000 have been authorized for extensions and improvements to the street-lighting system.

LONG PRAIRIE, MINN.—The installation of an ornamental lighting system on Osakis Street is under consideration by the City Council.

NEW PRAGUE, MINN.—Plans are being considered by the City Council for extensions and improvements in the municipal electric power plant including changing the system from direct to alternating current. The cost is estimated at $55,000. J. H. A. Brahtz, Builders' Exchange, St. Paul, is engineer.

PINE CITY, MINN.—The Eastern Minnesota Power Company is planning to install an improved street-lighting system. Alterations will be made in power plant, including the installation of a feed water heater, etc. An improved lighting system will also be installed by the company at Rush City.

BUSSEY, IOWA.—Permission has been granted the Grant Maddy Company by the State Railroad Commission to erect transmission line extensions in Marion and Monroe Counties.

CARROLL, IOWA.—The State Railroad Commission has granted the Iowa Heat, Light & Power Company permission to erect transmission lines in Cherokee, Ide and Sioux Counties.

CEDAR RAPIDS, IOWA.—The Central States Electric Company has been granted permission by the State Railroad Commission to make extensions to its transmission lines in Hamilton and Webster Counties.

DES MOINES, IOWA.—Permission has been granted the Des Moines Electric Light Company to extend its transmission line from the county line to Saylorville.

DUBUQUE, IOWA.—The State Railroad Commission has granted the Interstate Power Company, 327 South La Salle Street, Chicago, permission to make service improvements in Kossuth and Allamakee Counties.

HOLSTEIN, IOWA.—The Holstein Service Company has been granted permission to erect several transmission line extensions in Ide County.

ARGYLE, MO. — The Town Council is considering the erection of a 30-mile, 13,200-volt transmission line to supply electric service in the towns of Meta, Koeltztown, Argyle, Freeburg and Westphalia, at a cost of about $85,000. W. S. Merkle, 414 North Twelfth Street, St. Louis, is engineer.

LUTESVILLE, MO. — Preliminary surveys and plans are being prepared by the Town Council for the erection of 32 miles of transmission lines to supply electricity in the towns of Delta, Allenville, Whitewater, Laflin, Leopold, Lutesville, Marble Hill, Glen Allen and Marquand. The cost is es-

timated at $150,000. W. S. Merkle, 414 North Twelfth Street, St. Louis, is engineer.

ST. LOUIS, MO.—Bids will be received by the Commissioner of Indian Affairs, 310 Elm Street, St. Louis, until June 1, for batteries, flexible cord, sockets, attachment plugs, etc., as required during the fiscal year (Class 22-A).

ST. PETERS, MO.—The East Missouri Power Company, Troy, has been granted a street-lighting franchise in St. Peters.

MAPLETON, N. D.—The Union Light, Heat & Power Company, Fargo, plans to erect a transmission line from Fargo to Mapleton to cost $45,000. Plans are also being considered for the erection of a high-tension line from Mapleton to Hillsboro.

HERREID, S. D.—The proposal to sell the municipal electric plant to the Northern Power & Light Company, Mobridge, has been approved by the voters. It is planned to connect the local system with the Selby-Mound City high-tension line.

HUTCHINSON, KAN.—The Carey Salt Company has applied to the City Commission for permission to erect a transmission line from the power plant at its salt works to the Carey ice and cold storage plant. Provision is made in the ordinance for the sale of electricity to the city any time that the city may rqeuire it.

LAWRENCE, KAN.—The Kansas Electric Power Company has petitioned the Public Service Commission for approval of a high-tension transmission line to serve oil fields in Lyon and Greenwood Counties.

OSAWATOMIE, KAN.—An election will be held soon to vote on the proposal to issue $55,000 in bonds for improvements to the municipal electric light and water plant. Burns & McDonnell, 401 Interstate Building, Kansas City, Mo., are engineers.

WICHITA, KAN. — The Kansas Gas & Electric Company has applied to the Public Service Commission for permission to erect a high-tension line in Sedgwick to furnish service in rural districts.

Southern States

LAKE WACCAMAW, N. C.—Plans for the proposed local veneer and lumber mill of the North Carolina Lumber Company include a power plant.

ROCKY MOUNT, N. C. — Plans are under way by the Carolina Power & Light Company, Raleigh, for the erection of a high-tension transmission line from Zebulon to Rocky Mount, a distance of from 35 to 40 miles. A. W. Thompson, Raleigh, is engineer.

GILMANIA, S. C. — Plans have been filed by the Savannah River Lumber Company for a power plant in connection with an addition to its plant, to cost about $90,000.

BAINBRIDGE, GA.—The Bainbridge Ice Company plans to replace all steam-driven equipment in its ice plant with electrically-operated machinery.

CUTHBERT, GA.—Arrangements have been made by the South Georgia Power Company, Albany with the City Council whereby it will lease the municipal electric system and supply electricity here. The company plans to erect a transmission line from Albany to Dawson via Shellman to Cuthbert. Later the line will be extended from Credille Mill plant to Cuthbert, connecting with the line from Albany.

WAYCROSS, GA.—The Ware County Light & Power Company contemplates extending its transmission line to supply electricity in Homerville, Manor, Argyle, Dupont, Stockton and Naylor.

LAKE CITY, FLA.—The Florida Power & Light Company, Miami, which has acquired the municipal plant, plans extensions in transmission lines for local service.

LAKE STEARNS, FLA.—The City Council is considering establishing a municipal electric light plant.

MELBOURNE, FLA.—A bond issue of $30,000 for municipal improvements is under consideration by the City Commission of which $5,000 will be used for electric signs.

PALATKA, FLA.—Plans for the proposed local cement block and limestone plant to be erected by Burt Brothers, Kean Block, include a power plant.

PUNTA GORDA, FLA.—Plans are being considered by the Florida Power & Light Company, Miami, to build a 5,000-kw. electric generating plant here.

TARPON SPRINGS, FLA.—The Pinellas County Power Company, St. Petersburg, plans to build a substation in Tarpon Springs, to cost $500,000, to serve the cities in the western part of Florida with electricity. Seven transmission lines feeding Tampa, St. Petersburg, Clearwater, Dunedin and a number of other cities will be merged into the new plant.

BENTON, TENN.—The Tennessee Electric Power Company, Chattanooga, plans extensions and improvements in the local light and power system.

CHATTANOOGA, TENN.—The Southern Cities Power Company has applied for an approval of a franchise granted by the County Courts of Perry, Wayne and Hardin Counties and the city of Linden.

KNOXVILLE, TENN.—Steps have been taken by the civic and business organizations for the installation of an ornamental lighting system in the business section. Estimates of cost are being prepared by the Knoxville Railway & Light Company.

PIKEVILLE, TENN. — Application has been made to the Public Utilities Commission by J. V. Wigle, Pikeville, for approval of a franchise granted by the Commissioners of Van Buren County to erect a transmission line across the county.

MOSS POINT, MISS. — The Southern Paper Company plans to build an addition to its power plant, and install additional generating machinery, etc.

BASTROP, LA.—The Bastrop Pulp & Paper Company plans to install electric power equipment in connection with proposed additions to its mill, to cost about $1,000,000.

LAKE CHARLES, LA.—Plans are being considered by the Louisiana Electric Company, a subsidiary of the Eastern Texas Electric Company, Dallas, Tex., for the erection of high-tension lines to connect with the high-tension lines from Houston and Beaumont, Tex., along the Southern Pacific Railway to Baton Rouge.

TALLULAH, LA.—The installation of new equipment in the municipal electric light plant is under consideration by the City Council.

WATTS, OKLA.—The Southwest Power Company, McAlester, which has contracted to supply electricity in Watts, plans to erect a transmission line from Fayetteville to furnish the service.

AUSTIN, TEX.—Bids will be received by the Board of Trustees, University of Texas, until May 1, for power plant equipment at institution, including generator set, boilers, stokers, pumps, coal and ash-handling equipment, water-treating plant, etc. The H. M. Greene Company, Santa Fe Building, Dallas, Tex., is architect.

CUERO, TEX.—Plans have been adopted by the Texas Central Power Company, San Antonio, for the construction of a dam and hydro-electric plant on the Guadalupe River at a point between Victoria and Cuero, with an initial capacity of 3,000 hp.

Pacific and Mountain States

EVERETT, WASH.—The City Commissioners are considering the installation of an improved lighting system in the business district, to cost about $40,000.

PORT ARTHUR, TEX.—The City Council is considering extending the ornamental lighting system on Fifth Street and Fort Worth Avenue.

PORT ANGELES, WASH.—Contract has been awarded by the Northwestern Power Company, for clearing right-of-way, a distance of 8 miles, for a proposed transmission line along the banks of the Elwha River, near Port Angeles.

TACOMA, WASH.—The City Council is considering the installation of an improved street-lighting system on a number of streets, to cost about $40,000.

TACOMA, WASH. — The City Council plans to build a substation near the city limits at a cost of about $25,000, to furnish power to the Peninsula Lighting Company from the municipal plant, to be distributed in the Gig Harbor district by the Peninsula company.

ASTORIA, ORE.—The Pacific Newsprint Mills, Inc., Astoria, care of the Delta Engineering Company, Portland, Ore., plans to build a power plant at its proposed local pulp and paper mill on the Youngs River. The entire project will cost about $2,000,000.

PORTLAND, ORE.—The City Council is considering a petition for the installation of ornamental lamps on Eleventh Street, between Morris and Jefferson Streets.

PORTLAND, ORE.—To serve electricity to small communities, farms, etc., in the vicinity of the Mount Hood Loop Highway in Clackamas County, the Loop Electric Corporation, Portland, has been formed. The company will purchase electricity from the Sandy plant of the Portland Electric Power Company, and erect a three-phase, 11,000-volt transmission line from Sandy about 25 miles long, to a point beyond Rhododendron in the Mount National Forest. From this line 6,600 and 2,300-volt lines will be extended to reach all business in the territory. George A. Curtis is president, and G. M. Williams is treasurer of the company.

BURBANK, CAL.—The City Council has authorized the installation of ornamental lamps on San Fernando Boulevard.

LOS ANGELES, CAL.—The Municipal Water & Power Bureau plans extensions and improvements in the substation at 120 East Fourth Street, to cost about $45,000.

LOS ANGELES, CAL.—The City Council has adopted ordinances authorizing installation of ornamental lamps on Temple Street, using pressed steel standards; Redondo Boulevard, concrete standards; Western Avenue, pressed steel standards; portion of Beverly Drive, concrete standards, and Wilton Place, pressed steel standards.

PITTSBURG, CAL.—The Pioneer Rubber Company plans to build a power house at its plant, to cost about $20,000. B. G. McDougal, 393 Sacramento Street, San Francisco, is architect.

RYDE, CAL.—Plans are under way by the Great Western Power Company, San Francisco, to build a local substation, of 9,000 kva. capacity, to cost about $200,000.

SPRINGVILLE, UTAH.—Extensions to the municipal power plant in the Hobble Creek section are under consideration by the City Council.

MINIDOKA, IDAHO.—An appropriation of $300,000 has been made for the installation of an additional power unit at the local reclamation development. The work will be carried out by the Denver (Colo.) branch of the Bureau of Reclamation, Department of the Interior, Washington, D. C.

Canada

KIRKLAND LAKE, ONT.—Plans for the proposed local gold mining plant to be built by the Sylvanite Gold Mines, Ltd., 110 Franklin Street, Buffalo, N. Y., to cost about $100,000, include a power plant.

LEASIDE, ONT.—Large concessions have been granted the Leaside Engineering Company by the Quebec Government, including 1,000 square miles of timber limits, and two water power in the Lake St. John district. This concession is the basis for a large project, including 25 miles of railway extension, a pulp and paper mill of 200 tons daily capacity, a town site to house 3,000 people, and two hydro-electric developments.

TORONTO, ONT.—The installation of a new switchboard at the main water pumping station, to cost about $63,000, has been recommended by Works Commissioner Harris.

TORONTO, ONT.—The Hydro-Electric Power Commission of Ontario plans to extend its transmission lines from Vittoria to St. Williams, Port Royal, Port Rowan, Clear Creek and Erieview. The proposed line will be about 30 miles long, and will cost about $100,000.

CHELSEA, QUE. — An agreement has been authorized by the Ontario government for the delivery by the Gatineau Power Company, a subsidiary of the International Paper Company, 100 East Forty-second Street, New York City, at the Quebec-Ontario boundary in the vicinity of Ottawa of from 230,000 hp. to 260,000 hp. of hydro-electric energy at a maximum voltage of 220,000. Delivery will commence with a block of 80,000 hp. in 1928. This power will be transmitted by the Hydro-Electric Power Commission of Ontario from a point near Ottawa to connect with the Niagara system near Toronto, a distance of about 220 miles. The proposed lines will cost from $10,000,000 to $20,000,000. Work on these lines will begin at once.

FARNHAM, QUE.—Application has been made to the Public Service Commission by the Southern Canada Power Company, Ltd., Montreal, to erect a transmission line from Farnham to St. Cesaire, a distance of 12 miles.

SHAWINIGAN FALLS, QUE.—Application has been made by the Electric Service Corporation to the Public Service Commission for permission to erect a 25,000-volt transmission line, 40 miles long, connecting St. Jean-Deschaillons, Leclercville, Lotbiniere, Ste. Croix, St. Antoine and St. Nicholas to Chaudiere.

Electrical Patents

Announced by U. S. Patent Office

(Issued March 30, 1926)

1,578,335. ELECTRIC BAKE OVEN; J. U. Manischewitz, Cincinnati, Ohio. App. filed Feb. 4, 1921. In which are employed a plurality of electric heating elements arranged in series-parallel combinations for effecting any desired temperature by utilizing different voltages and keeping the current constant.

1,578,354. ELECTRIC SWITCH; G. W. O'Keeffe, Dorchester, Mass. App. filed July 3, 1922. Adapted to the control of small induction motors and having quick-make means

1,578,358. ELECTRIC LAMP FOR CINEMATOGRAPHIC APPARATUS; E. C. Penin, Joinville-le-Pont, France. App. filed Feb. 23, 1924.

1,578,360. THERMOSTATIC INSTRUMENT; H. G. Phelps, Milwaukee, Wis. App. filed Jan. 24, 1924. Thermostatically actuated contact making and breaking switch designed for use in connection with refrigerating plants.

1,578,362. IRON-VANE INSTRUMENT; R. T. Pierce, Wilkinsburg, Pa. App. filed June 15, 1921. Measuring instrument provided with a scale of greater effective length than has been usual in iron-vane instruments.

1,578,411. ELECTROMAGNETIC RELAY; J. Erickson, Chicago, Ill. App. filed Oct. 1, 1920. Alternating-current relay which will attract its armature when energized and hold the same steady in attracted position.

1,578,422. INCLOSED QUICK-MAKE AND QUICK-BREAK SWITCH; B. E. Getchell, Plainville, Conn. App. filed Jan. 13, 1923. Including an interlocking engagement of the cover with the switch-operating parts.

1,578,437. ELECTRIC LAMP-SUPPORTING STRUCTURE; M. Herskovitz, Chicago, Ill. App. filed Feb. 6, 1922. Of the type which is supported from a base, as is common with table or floor lamps.

1,578,485. ELECTRIC SWITCH; S. H. Todd, Highland Park, Mich. App. filed May 6, 1922. A switch which can be operated by a small amount of movement and which when moved a small initial distance will complete the movement by energy stored during the initial movement.

1,578,501. ELECTRICAL MEASURING INSTRUMENT; L. Dorfman, Wilkinsburg, Pa. App. filed Dec. 7, 1920. Volt-ampere-hour meter which under ordinary operation and connection is adapted to register watt-hours, with inductive means whereby the meter will register volt-ampere hours. The potential winding of an ordinary induction-type watt-hour meter is connected to the circuit, the volt-amperes of which are to be measured and interposed between the current winding thereof, and the circuit is an induction regulator which is adapted to be deflected in accordance with the current in the circuit so that the current which traverses the current winding of said meter shall be proportional to the current traversing the potential winding, irrespective of the power factor of the circuit.

1,578,506. METER MOUNTING; S. A. Gafvert, New York, N. Y. App. filed Sept. 16, 1922.

1,578,508. INSULATOR; H. L. Garbutt, Wilkinsburg, Pa. App. filed May 7, 1919. Suspension type.

1,578,509. FLUID-PRESSURE CONTROL OF TURBO VENTILATION; R. E. Gilman and C. J. Fechheimer, Pittsburgh, Pa., and D. Bratt, Irwin, Pa. App. filed July 20, 1923.

1,578,510. TURBO VENTILATION; R. E. Gilman, Pittsburgh, Pa. App. filed Oct. 5, 1923. Means for producing a baffle ring in the air gap for controlling or equalizing the distribution of radial air velocities in the stator-ventilating ducts.

1,578,526. INSULATOR; R. P. Jackson, Edgewood Park, Pa. App. filed March 31, 1920. Suspension insulators.

1,578,527. ELECTRIC SWITCH; R. T. Kintzing, Wilkinsburg, Pa. App. filed April 21, 1921. Automatically operated; as used in the operation of electrically driven machinery to effect a quick cessation of movement.

1,578,539. BRUSH HOLDER; F. W. McCloskey, Edgewood, Pa. App. filed June 24, 1924. Totally inclosed brush-holder construction for preventing carbon side wear in machines employing ventilation by means of air drawn from outside the machine frame.

1,578,552. INDUCTIVE ARRANGEMENT FOR SIGNALING OVER POWER LINES; C. Schwarz, Charlottenburg, near Berlin, Germany. App. filed Oct. 31, 1921. Arrangements for imposing currents of radio frequency upon the line wires of a power-transmission system or for inductively receiving radio-frequency currents from such a line.

1,578,563. CIRCUIT CLOSER; J. W. Thomas, Fullerton, Pa. App. filed Jan. 19, 1921. Adapted for use in conjunction with containers, more especially a tank or bin for liquids or finely divided solids such as pulverized coal, to control the filling of the container and to indicate as well when the bin is empty, by the intermediate progressive levels of the material during the filling and emptying of the bin.

1,578,571. VOLT-AMPERE METER; D. J. Angus, Indianapolis, Ind. App. filed Jan. 27, 1922. A structure in which one or more actuators act on a meter disk. Each actuator comprises a field magnet having poles in proximity to the meter disk and a rotatably shiftable armature between the poles adjacent to the meter disk, one of the elements of each actuator being excited in proportion to the voltage and the other in proportion to the current of an alternating-current circuit, and one of them, the armature, being excited to produce a rotating or shifting field.

1,578,572. CIRCUIT BREAKER; W. M. Austin, Swissvale, Pa. App. filed Sept. 16, 1922. Controlling device for effecting the tripping of the breaker upon the occurrence of predetermined current conditions and to prevent the operation of the latching mechanism when such changes in current conditions are of merely momentary duration.

1,578,575. ELECTROMAGNETIC BRAKE; E. M. Bouton, Wilkinsburg, and M. G. Thompson, Ardmore, Pa. App. filed Sept. 8, 1919. Alternating-current type.

1,578,576. TURBO VENTILATION; D. Bratt, Irwin, and C. J. Fechheimer, Pittsburgh, Pa. App. filed June 26, 1923. A machine in which groups of radial spaces are arranged for intake ducts and discharge ducts respectively, the number of ducts in each group having a definite relation to the ratio between the radial duct area and the air-gap area.

1,578,577. TURBO VENTILATION UTILIZING BAFFLES IN AIR GAP; D. Bratt, Irwin, Pa. App. filed June 26, 1923. Type of machine which is ventilated by means of air admitted to the periphery of the stator as well as air admitted to the ends of the air gap, the ventilation being secured by a circulation radially through ventilating ducts in the stator and axially through the air gap.

1,578,578. LIGHTNING ARRESTER; E. W. Breisch, Edgewood, Pa. App. filed March 15, 1922. Spark-gap type.

1,578,603. ELECTRIC HEATING APPARATUS FOR LIQUIDS; K. F. Henneman, The Hague, Netherlands. App. filed Aug. 14, 1924.

1,578,604. ELEVATOR SAFETY DEVICE; H. G. Hillman, New York, N. Y. App. filed April 8, 1922. Automatically operated and arranged so that whenever a door leading into the elevator shaftway or the collapsible gate on the elevator cage is opened it will lock the controlling mechanism of the car.

1,578,662. ELECTRIC OVEN; F. L. Hunter, East Orange, N. J. App. filed Nov. 19, 1921. For heating vacuum tubes during the pumping thereof.

1,578,667. BINDING POST; Le Roy W. Kelsay, New York, N. Y. App. filed Aug. 3, 1923. Easily assembled in a wooden panel and when assembled will maintain the post securely in the desired position regardless of the shrinking or swelling of the wood.

1,578,719. LIGHTING SYSTEM; A. R. Dennington, East Orange, N. J. App. filed Sept. 24, 1920. Series lighting system of a character that will automatically substitute an equivalent or compensating resistor for a lamp in the event of the removal of or damage to the latter and that will operate quickly to prevent damage to adjacent objects when fracture of the filament or other damage to the lamp causes a sustained arc therein.

1,578,750. PORTABLE ELECTRIC SUCTION CARPET SWEEPER AND CLEANER; I. J. Owen, Grand Rapids, Mich. App. filed April 17, 1922.

1,578,783. ELEVATOR SIGNAL SYSTEM; P. S. Van Bloem, Hempstead, N. Y. App. filed Sept. 18, 1923.

1,578,793. COMMUTATOR AND THE METHOD OF MAKING IT; V. G. Apple, Dayton, Ohio. App. filed July 3, 1920.

1,578,813. COMPOSITE INSULATING BODIES AND METHOD OF PRODUCING THEM; C. L. Dawes and W. A. Boughton, Cambridge, Mass. App. filed Oct. 26, 1922. Composite insulating plates or other bodies comprising mica flakes or fragments and a binding material which adhesively integrates the composite assemblage, utilizing as binding material silicates of the alkali metals, either singly or in composition and either with or without mixture with other salts.

1,578,828. TRAFFIC REGULATOR; F. J. Husbands, Los Angeles, Cal. App. filed March 15, 1921. Being either independently locally controlled or simultaneously controlled from a central station.

1,578,837. REVERSIBLE MOTOR; R. L. Lee, Dayton, Ohio. App. filed March 13, 1924.

1,578,857. ELECTRODE FOR ELECTROLYTIC CELLS; H. O. Siegmund, West Orange, N. J. App. filed Aug. 21, 1923. For use as an electrolytic condenser on circuits of unidirectional potential.

1,578,860. STARTING MECHANISM FOR ALTERNATING-CURRENT MACHINES; J. Sousedik, Vsetin, Czechoslovakia. App. filed Sept. 16, 1922. For asynchronous motors of any size and number of phases and comprising a rotor of one or more windings.

1,578,878. ELECTROMAGNETIC SWITCH MECHANISM; H. W. Cheney, Milwaukee, Wis. App. filed Feb. 9, 1921. For automatic motor starters.

1,578,891. DRY CELL; W. F. Hendry, Ossining, N. Y. App. filed Dec. 27, 1923. Having a low internal resistance and also means for freer circulation of gas generated by the reactions taking place in the cell.

1,578,913, 1,578,914, 1,578,915. GENERATOR; L. M. Perkins, Syracuse, N. Y. Apps. filed Oct. 20, 1920. April 18, 1922, and June 1, 1922. Third-brush type.

1,578,916. FIELD WINDING FOR ELECTRIC MACHINES; L. M. Perkins, East Pittsburgh, Pa. App. filed April 13, 1922. The production of a field winding for a multipolar machine in a single operation.

1,578,918. DYNAMO-ELECTRIC MACHINE AND METHOD OF VENTILATING SAME; W. H. Powell, Milwaukee, Wis. App. filed Dec. 3, 1920.

1,578,925. MOTOR CONTROLLER; E. W. Seeger, Milwaukee, Wis. App. filed April 10, 1925. For two-motor printing presses or press units.

1,578,971, 1,578,972. SPEED-CONTROL SYSTEM; L. Fleischmann, Berlin, Germany. App. filed Aug. 11, 1924. Wherein a rotary-converter exciter driven at a speed proportional to that of the motor is utilized to regulate the motor excitation in a manner to prevent objectionable variations in the motor speed.

1,578,973. ARC DEVICE; J. Force, Livingston, N. J. App. filed March 1, 1922. In which an arc is operated in a gaseous atmosphere between electrodes of which either the negative electrode alone or both electrodes operate at incandescence.

1,578,999. OUTLET BOX AND PLATE THEREFOR; G. E. Kaschub, Meriden, Conn. App. filed March 16, 1923.

1,579,008. WIRE TERMINAL CONNECTOR; J. Lake, Jr., New York, N. Y. App. filed May 21, 1921.

1,579,018. ELECTRICAL CONTROLLER; W. R. Milburn, Milwaukee, Wis. App. filed Aug. 5, 1922. Manually operable acceleration controller of the drum type.

1,579,038. MOTOR REGULATOR; C. H. Smoot, Maplewood, N. J. App. filed Feb. 27, 1925. For variable-speed motors controlled from a central point.

1,579,049. RETARDATION DEVICE; C. D. Ainsworth, Wollaston, Mass. App. filed May 19, 1921. Adapted to delay the control of an electric circuit; time-delay relay.

1,579,050. WIRE CONNECTION FOR ELECTRIC PLUGS; O. Abbadini, Fairbank, Pa. App. filed Nov. 11, 1922. Which will admit of the wire being quickly connected and readily disconnected as may be required and which will avoid torsional strain, as provision is had for a relative turning of the parts while at the same time maintaining firm electric connection.

1,579,051. ELECTRIC SHIP PROPULSION; E. F. Alexanderson, Schenectady, N. Y. App. filed Dec. 11, 1920. An adjustable-speed turbine which is arranged to drive a generator connected to supply a reversible motor or motors directly connected to a propeller or propellers.

1,579,058. ELECTRIC ARC LAMP; S. B. Ausas, Barcelona, Spain. App. filed May 13, 1921. Automatically regulated when the carbons occupy a vertical position as well as when the carbons are disposed horizontally or inclined.

1,579,092. ELECTRIC SNAP SWITCH; F. C. De Reamer, Bridgeport, Conn. App. filed March 4, 1924.

Table I—Data on Output a

These data include all ligh

Line No.	Company	Rank in 1925	1925 Peak Load Kw. (Instantaneous)	1925 Peak Load (Est. Over Thirty Minute Period) Kw.	1925 Date of Instantaneous Peak	1925 Output for Year Kw.-Hr.	1925 Average Load in Kw. 1925	1924 Peak Load Kw. (Instantaneous)	1924 Peak Load (Est. Over Thirty Minute Period) Kw.	1924 Date of Peak	1924 Outp
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
1	Niagara Falls Power Company	1	.....	437,016	Dec. 26	3,161,130,010	360,860	.....	423,542	.....	2,8
2	Commonwealth Edison Company	2	809,000	792,000	Dec. 23	3,091,424,000	353,000	717,000	697,000	Dec. 19	2,7
3	Edison-United Companies, New York (*N*)	3	656,312	642,907	Dec. 21	2,262,620,409	258,290	615,283	593,727	Dec. 23	2,0
4	Pacific Gas and Electric Company	4	380,084	.....	Nov. 4	2,001,474,640	228,479	343,701	.....	Dec. 19	1,8
5	Southern California Edison Company	5	395,900	.....	July 22	1,987,661,654	226,902	330,660	.....	Mar. 10	1,6
6	Detroit Edison Company	6	390,100	(*a*) 389,100	Oct. 2	1,732,420,700	197,800	335,800	333,400	Nov. 21	1,-
7	Philadelphia Electric Company System	7	387,200	361,600	Dec. 10	1,521,639,979	173,815	334,048	320,000	Dec. 22	1,-
8	Public Service Electric and Gas Company	8	367,048	353,000	Dec. 9	1,358,318,172	155,400	335,689	330,000	Dec. 22	1,-
9	Montana Power Company	9	172,600	168,900	Aug. 14	1,234,052,127	140,485	159,150	156,500	Dec. 15	1,-
10	Duquesne Light Company	10	271,200	264,900	Dec. 16	1,230,292,597	140,200	239,380	227,700	Dec. 16	1,0
11	No. American Co. (Mo., Ill. and Iowa) (*P*)	11	258,623	.....	Dec. 15	1,200,506,087	137,200	.....	.....	.....	...
12	Southeastern Power and Light Cos. System	12	291,000	284,000	Oct. 22	1,196,244,494	136,520	.....	.....	.....	...
13	Southern Power Company	13	.....	(*c*) 297,705	(*o*) Jan. 12	1,187,872,330	135,600	.....	(*o*) 287,000	Dec. 16	1,0
14	West Penn System	14	.....	209,720	(*n*) Dec. 22	1,090,203,588	124,452	.....	(*o*) 188,490	Dec. 23	
15	Cleveland Electric Illuminating Company	15	251,375	247,000	Dec. 17	989,409,700	113,000	227,954	222,000	Dec. 10	
16	Ohio Power Company	16	.....	181,600	(*n*) Dec. 22	890,509,813	101,700	.....	.....	.....	...
17	Niagara, Lockport and Ontario Pwr. Co.	17	.....	172,000	(*n*).....	872,402,171	99,700	.....	156,000	.....	
18	Buffalo General Electric Company	18	191,000	188,800	Dec. 8	869,317,170	99,200	174,000	169,500	Dec. 18	
19	North American Co. (Wisconsin System) (*Q*)	19	203,904	.....	Dec. 4	849,064,272	97,100	156,179	.....	Dec. 16	
20	Mohawk Hudson Power Corp. System	20	.....	171,100	(*n*) Nov. 24	809,964,028	92,460	.....	.....	.....	...
21	Brooklyn Edison Company	21	228,000	223,850	Dec. 17	783,019,562	89,386	201,600	196,850	Dec. 23	
22	Utah Power and Light Company	22	112,343	.....	Dec.	744,186,000	84,952	105,544	.....	Dec.	
23	Northern States Power Company	23	168,659	160,200	Dec. 2	742,601,203	84,800	156,619	152,000	Dec. 5	
24	Consol. Gas Elect. Lt. & Pwr. Co. of Balt.	24	.....	(*b*) 160,700	(*o*) Dec. 21	718,195,433	81,986	143,500	.....	Dec. 23	
25	Pennsylvania Power & Light Company	25	130,403	.....	Dec.	707,995,258	80,821	135,335	.....	Dec. 22	
26	Consumers Power Company	26	157,332	155,890	Sept. 15	686,548,440	78,530	146,789	144,640	Dec. 5	
27	New England Power Company	27	.....	(*c*) 165,200	(*o*) Jan. 20	681,696,046	77,850	.....	(*o*) 151,200	Dec. 2	
28	Tennessee Electric Power Company	28	155,000	142,300	Dec. 11	654,488,668	74,713	112,500	104,800	Dec. 10	
29	Edison Elect. Illum. Company of Boston	29	203,199	.....	Dec. 1	648,078,358	74,100	167,929	.....	Nov. 24	
30	Great Western Power Company	30	122,950	.....	Mar. 6	633,357,021	72,054	.....	(*e*) 121,800	Dec. 18	
31	Puget Sound Power and Light Company	31	131,468	130,000	Dec. 10	632,626,358	72,000	125,000	124,500	Dec. 19	
32	Public Service Co. of No. Illinois	32	(*d*) 166,390	(*e*) 165,484	Dec. 9	(*f*) 615,092,925	(*g*) 70,216	(*D*) 115,392	102,392	Dec. 5	(*E*) 5
33	Union Gas and Electric Company	33	.....	(*h*). 145,000	.....	562,408,247	64,223	(*D*) 125,200	.....	Dec. 17	
34	San Joaquin Light and Power Corp.	34	111,890	111,000	July 16	554,614,141	63,312	94,150	94,000	July 9	
35	Ohio Public Service Company	35	106,100	.....	Dec. 2	522,063,648	59,600	121,000	(*o*) 110,800	Dec. 3	
36	Washington Water Power Company	36	107,030	98,655	Oct. 30	515,523,750	58,849	91,824	78,028	Dec. 19	
37	Pennsylvania Water and Power Company	37	115,000	(*c*) 110,100	Nov. 13	513,962,900	58,700	98,200	(*o*) 97,000	April 16	
38	Los Angeles, Bureau of Power & Light	38	109,860	109,200	Dec. 16	479,878,822	54,781	101,162	99,984	Dec. 22	
39	Georgia Railway and Power Company	39	120,000	109,000	Dec. 2	435,441,973	49,700	98,000	48,000	Nov. 20–Dec. 9	
40	Portland Electric Power Company	40	.....	(*c*) 105,500	(*o*) Dec. 18	421,155,600	48,000	.....	(*o*) 91,600	(*o*) Dec. 19	
41	Pennsylvania-Ohio Power & Light Co.	41	(*i*) 100,000	94,000	.....	417,368,862	47,700	75,000	69,000	.....	
42	Metropolitan Edison System	42	87,000	84,000	Dec. 1	366,726,210	41,800	56,500	52,000	Dec. 17	
43	Minnesota Power and Light Co.	43	75,484	.....	Oct.	364,574,445	41,618	.....	(*o*) 68,375	Sept. 29	
44	Toledo Edison Company	44	(*k*) 81,500	(*k*) 79,400	Oct. 21	350,518,281	(*k*) 42,500	77,000	77,000	Dec. 15	
45	Penn Public Service System	45	84,765	76,885	Dec. 22	341,630,292	39,000	69,300	66,000	Dec. 16	
46	Kansas City Power and Light Company	46	.....	(*l*) 71,000	(*n*) Dec. 4	339,117,030	40,200	.....	(*e*) 67,723	(*e*) Dec. 4	
47	North West Utilities Company	47	.....	76,599	.....	336,956,523	38,465	.....	74,431	.....	
48	Potomac Electric Power Company	48	84,000	81,000	Dec. 16	318,700,406	36,380	77,000	74,000	Dec. 23	
49	Turners Falls Power and Light Company	49	71,800	63,500	July 2	317,772,280	36,280	56,700	55,000	Nov. 8	
50	Virginia Electric and Power Company	50	.....	79,440	(*n*) Dec. 15	304,400,743	34,749	.....	58,950	Dec. 23	
51	Northern Ohio Traction & Light Co.	51	.....	43,400	(*n*) Jan. 27	304,116,460	34,800	.....	(*L*) 47,400	Jan 9	
52	Rochester Gas and Electric Corp	52	72,070	62,814	Dec. 21	296,678,980	33,867	62,069	(*o*) 56,269	Dec. 12	
53	Appalachian Power Company	53	.....	(*c*) 62,800	Dec. 2	292,000,000	33,400	(*o*) 50,100	.....	(*o*) Nov. 25	
54	Connecticut Light and Power Company	54	.....	(*b*) 68,270	.....	287,165,218	32,800	.....	60,712	.....	
55	Narragansett Electric Lighting Co.	55	94,000	92,000	Dec. 21	278,445,000	31,787	.....	(*o*) 87,000	Feb. 14	
56	Dayton Power and Light Company	56	73,500	70,000	Dec. 21	275,502,706	31,440	72,000	68,000	Dec. 12	
57	Texas Power and Light Company	57	57,830	.....	Sept.	264,399,000	30,182	53,400	.....	Sept. 4	
58	Central Indiana Power Company System	58	74,800	65,000	Dec. 8	262,971,086	30,050	.....	.....	.....	...
59	Southern Sierras Power Company (*P*)	59	49,900	.....	July 16	260,300,140	29,715	40,500	.....	June 7–Oct. 21	
60	New Orleans Public Service, Inc.	60	65,000	.....	Dec.	252,735,340	28,851	56,000	55,000	Dec. 12	
61	Michigan Northern Power Company	61	.....	(*q*) 33,084	(*n*) Aug. 22	252,186,398	28,788	.....	(*r*) 30,297	(*r*) Dec. 9	
62	California Oregon Power Company	62	(*s*) 67,180	(*s*) 67,180	Oct. 20	(*t*) 251,310,788	(*s*) 28,613	36,222	36,222	Dec. 10	
63	Central Illinois Public Service Co.	63	65,000	61,350	Nov. 18	247,311,779	28,250	53,500	53,500	Dec. 30	
64	[illegible]lic Service Co. of Colorado	64	58,645	57,900	Dec. 22	244,055,341	27,900	55,000	52,000	Dec. 22	
65	Birmingham Electric Company	65	35,919	.....	Dec.	224,109,866	25,582	37,749	.....	Dec. 10	

Supplement to ELECTRICAL WORLD, April, 24, 1926

t and Peak Load of Largest Generatin in the United States and Canad

all lighting, power and electric railway companies in the United States and Canada having yearly output in excess

4			1923					1922			1921			
f	Output for Year Kw.-Hr. (12)	Average Load During 1924 Kw. (13)	Peak Load Kw. (14)	Peak Load (Est. Over Thirty Minute Period Kw. (15)	Date of Peak (16)	Output for Year Kw.-Hr. (17)	Average Load During 1923 Kw. (18)	Peak Load Kw. (19)	Date of Peak Load (20)	Output for Year Kw.-Hr. (21)	Peak Load Kw. (22)	Date of Peak Load (23)	Output for Year Kw.-Hr. (24)	Pe Lo K (2
....	2,858,482,674	325,419	356,515	.....	Dec. 28	2,595,847,000	296,329	328,826	Nov. 23	2,252,249,000	298,120	Dec. 22	1,855,120,000	303
9	2,787,090,000	317,000	624,000	624,000	Dec. 4	2,573,286,711	293,756	600,000	Dec. 12	2,225,442,875	525,640	Dec. 21	1,928,271,943	478
3	2,056,432,473	234,750	555,433	536,533	Dec. 5	1,899,679,975	217,000	497,577	Dec. 20	1,659,269,781	422,721	Dec. 14	1,475,276,053	398
9	1,887,113,680	214,835	306,945	306,945	Dec. 12	1,725,619,492	196,989	293,708	Nov. 10	1,608,940,735	265,925	Nov. 29	1,489,088,657	259
0	1,664,151,512	189,453	312,500	.....	Oct. 17	1,548,896,120	173,248	239,160	Aug. 28	1,198,926,369	238,480	Dec. 13	1,224,718,196	213
1	1,460,631,400	166,300	303,600	303,600	Dec. 5	1,360,017,300	155,300	254,700	Dec. 7	1,105,211,100	201,500	Nov. 23	897,980,200	218
2	1,313,297,283	154,588	299,438	289,200	Dec. 27	1,148,511,101	135,785	260,355	Dec. 14	956,910,225	213,570	Dec. 8	877,047,595	203
2	1,198,240,840	136,800	282,654	280,500	Dec. 5	1,084,990,294	122,700	249,778	Dec. 18	958,407,194	213,502	Nov. 28	821,198,975	216
5	1,121,245,976	127,646	156,500	156,500	July 26	1,122,750,450	128,168	135,600	Aug. 10	963,662,660	116,600	Jan. 1	572,277,989	159
6	1,093,939,801	124,538	219,500	.....	Nov. 20	1,063,046,267	119,477	208,980	Dec. 13	858,329,336	164,240	Feb.	702,897,985	162
6	1,054,909,770	120,000	270,800	.....	Dec. 11	1,001,026,319	114,272	233,000	July	910,488,432	218,300	Feb.	790,000,000	210
3	995,609,902	113,002	181,000	.....	Dec. 18	945,691,000	108,000	137,354	Dec. 11	634,674,505	106,919	Dec. 2	516,829,636	104
0	865,079,266	98,484	187,275	184,800	Dec. 20	802,859,991	91,651	181,112	Dec. 14	688,149,162	141,850	Dec. 15	564,819,267	155
....	721,454,633	.....	142,000	142,000	Dec. 13	707,087,842	80,718	127,000	Nov. 24	552,035,090	87,000	Nov. 2	415,153,634	88
8	759,852,160	86,500	154,800	152,500	Dec. 20	707,958,270	80,800	142,000	Dec. 7	587,682,340	115,000	Nov. 14	479,862,700	108
6	595,329,699	67,800	138,291	138,291	Nov. 27	553,624,392	63,427	134,482	Dec. 19	458,405,215	98,887	Nov. 22	375,354,892	90
3	684,632,824	77,941	180,000	174,000	Dec. 20	598,808,757	68,357	164,495	Dec. 7	516,987,870	137,800	Dec. 6	438,887,775	116
	749,653,000	85,500	105,452	.....	Dec.	621,977,000	71,000	87,158	Dec. 19	428,912,903	75,661	Jan. 8	362,908,000	85
5	691,099,810	78,677	149,196	144,989	Nov. 26	636,428,456	72,652							
3	648,307,210	73,919	138,410	.....	Dec. 19	678,346,746	77,437	138,800	Dec. 13	568,669,404	108,330	Nov. 30	415,335,614	88
2	630,923,200	72,023	116,453	.....	Nov. :	602,691,800	68,800	106,987	Nov. 14	495,344,612	84,203	Sept. 27	442,507,974	87
5	602,152,714	68,559	139,849	137,052	Sept. 18	574,031,472	65,529	116,130	Dec. 4	461,840,561	95,410	Dec. 12	397,815,027	106
2	562,802,440	107,600	139,314	.....	Oct. 23	575,067,581	65,647	125,460	Dec. 14	469,993,180	112,200	Nov. 9	405,979,457	103
0	477,593,985	54,371	93,700	97,500	Mar. 5	460,097,505	52,500	82,700	Dec. 11	353,320,559	69,100	May 16	342,948,926	74
24	564,459,887	64,260	153,123	.....	Dec. 10	526,465,178	60,099	133,594	Dec. 14	439,448,099	128,200	Dec. 15	375,025,955	105
8	617,482,000	70,068	116,800	116,800	Dec. 12	589,597,024	65,673	105,910	Dec. 5	572,693,958	95,540	June 7	490,584,257	80
9	607,067,218	69,000	124,300	124,300	Dec. 19	577,578,440	65,933	105,600	Dec. 4	474,042,886	99,800	Dec.	419,197,581	95
5	(E) 514,065,402	(i) 54,706:	98,017	96,943	Dec. 4	427,460,666	48,797	82,737	Dec. 19	362,220,201	80,563	Dec. 30	415,940,095	....
7	480,219,880	61,923	112,000	107,000	Dec. 20	438,386,388	50,044	100,000	Dec. 13	366,071,350	75,000	Dec. 14 & 23	281,537,273	65
9	573,821,266	56,000	73,425	73,425	July 27	465,458,706	53,154	67,885	Aug. 4	451,390,040	61,700	June 27	396,174,690	47
3	417,544,531	47,500	92,723	.....	Dec.	415,424,787	47,423	80,080	Nov.	316,838,000	.....			
9	426,053,680	47,660	86,487	84,955	Nov. 9	413,240,900	46,487	89,278	Dec. 12	407,657,100	70,110	Nov. 23	374,378,300	63
16	487,859,000	55,500	85,000	84,400	Jan. 3	420,028,600	47,900	83,000	June 10	373,341,800	83,000	Nov.	419,987,000	85
2	437,209,701	48,104	98,945	98,096	Dec. 13	426,337,964	48,669	75,275	Dec. 15	318,502,702	51,900	Dec. 21	300,353,806	46
Dec. 9	395,219,890	45,116	91,500	85,000	Oct. 4	358,353,618	40,800	80,000	Nov. 15	317,068,699	72,000	Nov. 3 & 28	282,084,977	76
. 19	394,013,720	45,000	81,500	81,800	Dec. 20	365,997,750	41,780	71,800	Dec. 28	324,116,190	64,800	Dec. 20	298,514,571	62
....	341,939,101	38,900	61,100	61,100	Jan. 19	340,864,488	38,911	64,200	Nov. 20	276,936,464	45,300	Nov. 9	202,670,200	48
7	194,606,000	35,000	41,600	41,000	Dec.	168,814,810	19,271	32,100	Nov. 20	127,315,007	27,900	Nov. 30	99,815,200	28
29	340,181,750	38,725	50,300	.....	May 22	251,144,646	28,950							
5	279,848,936	31,900	73,000	73,000	Dec. 5	273,643,372	31,238	58,000	Dec. 14	215,785,945	46,700	Dec. 13	179,121,428	52
6	298,707,292	34,000	57,000	48,000	Jan.	182,281,000	20,808							
c. 4	315,582,737	35,925	62,800	.....	Sept. 27	289,903,699	34,450	59,490	Dec. 6	253,305,000	50,531	Dec. 23	204,752,604	35
.....	298,281,324	34,000	43,439	43,439	Sept.	203,997,334	23,287	43,589	Dec.	163,902,506	31,885	April	132,788,852	....
23	286,695,035	32,640	70,000	68,160	Dec. 27	269,870,850	30,807	70,000	Dec. 20	251,984,618	65,000	Dec. 14	238,028,571	62
8	238,574,255	27,236	59,600	59,600	June 13	217,138,000	24,800	56,400	May 16	201,796,000	57,900	May 17	170,826,000	53
23	276,563,178	31,580	56,400	62,000	Dec. 18	262,940,313	30,000	54,250	Dec. 18	230,293,745	47,000	Dec. 14	208,323,000	46
9	267,074,055	43,150	46,400	46,400	Dec. 10	259,720,216	29,100	43,000	Dec.	232,684,874	42,000	Oct. 12	187,249,647	44
12	267,223,754	30,353	61,824	56,124	Dec. 6	248,156,900	28,330	53,040	Nov. 23	193,503,573	48,734	Dec. 16	185,480,692	49
. 25	244,300,000	27,820	47,800	.....	.....	244,600,000	27,900	42,600	Dec. 4	205,447,368	35,600	Dec. 19	154,500,000	33
.....	227,558,428	22,602	50,900	53,450	Dec. 5	196,432,892	22,400	45,706	Dec. 14	158,371,247	28,255	Nov. 28	101,129,915	33
14	289,626,000	33,062	88,000	.....	Nov. 21	373,505,000	42,638	85,000	Dec. 4	297,400,000	72,000	Nov. 23	243,087,000	54
12	249,330,663	29,062	58,500	57,000	Dec. 10	196,615,340	22,444	46,500	Dec. 8	159,836,687	37,500	Nov. 28	134,588,457	3
4	262,187,000	29,917	37,570	.....	Dec. 17	225,453,000	25,736	66,560	Dec. 13	183,536,613	33,620	Sept. 22	156,851,213	3
ct. 21	226,680,958	25,806	40,100	.....	June 11	219,653,900	25,011	36,200	July 14	186,671,850	45,700	June 6 & Aug. 8	199,453,965	3
12	226,584,380	26,000	51,700	.....	Dec.	211,765,420	24,174	46,500	Dec. 13	188,000,000	.....	.....	.....	.....
. 9	258,750,604	29,457	34,510	.....	Oct. 19	261,577,017	29,860	32,449	Nov. 3	246,175,203	35,018	Aug. 14	258,249,673	3
10	180,554,058	20,000	32,463	32,463	Nov. 20	153,500,531	17,523	27,695	Dec. 20	131,293,165	20,270	March 16	133,091,607	2
30	202,871,998	22,100	42,300	42,300	Sept. 5	174,670,219	19,941	30,800	Oct.	128,345,120	26,300	Dec.	114,587,986	....
22	216,151,037	24,600	.....	.....	Dec.	145,302,874	16,587	28,800	Dec.	102,631,000	.....	.....	.....	.....
10	193,987,141	22,144	35,202	.....	Dec. 5	162,443,207	18,544	.....	.....	.....	.....	.....	.....	.....

62	California Oregon Power Company	62	(s) 67,180	(s) 67,180	Oct. 20	(t) 251,310,788	(s) 28,613	36,222	36,222	Dec. 10					
63	Central Illinois Public Service Co.	63	65,000	61,350	Nov. 18	247,311,779	28,250	53,500	53,500	Dec. 30					
64	Public Service Co. of Colorado	64	58,645	57,900	Dec. 22	244,055,341	27,900	55,000	52,000	Dec. 22					
65	Birmingham Electric Company	65	35,919		Dec.	224,109,866	25,582	37,749		Dec. 10					

Supplement to ELECTRICAL WORLD, April, 24, 1926

eak Load of Largest Generating and the United States and Canada

nd electric railway companies in the United States and Canada having yearly output in excess of 100,000,000 kw.-h

1923					1922			1921			1920		
Peak Load Kw. (14)	Peak Load (Est. Over Thirty Minute Period Kw. (15)	Date of Peak (16)	Output for Year Kw.-Hr. (17)	Average Load During 1923 Kw. (18)	Peak Load Kw. (19)	Date of Peak Load (20)	Output for Year Kw.-Hr. (21)	Peak Load Kw. (22)	Date of Peak Load (23)	Output for Year Kw.-Hr. (24)	Peak Load Kw. (25)	Date of Peak Load (26)	Output Yea Kw.-H (27
356,515	.....	Dec. 28	2,595,847,000	296,329	328,826	Nov. 23	2,252,249,000	298,120	Dec. 22	1,855,120,000	303,640	April 29	2,328,32
624,000	624,000	Dec. 4	2,573,286,711	293,756	600,000	Dec. 12	2,225,442,875	525,640	Dec. 21	1,928,271,943	478,820	Dec. 17	1,883,57
555,433	536,533	Dec. 5	1,899,679,975	217,000	497,577	Dec. 20	1,659,269,781	422,721	Dec. 14	1,475,276,053	398,535	Dec. 6 & 22	1,383,07
306,945	306,945	Dec. 12	1,725,619,492	196,989	293,708	Nov. 10	1,608,940,735	265,925	Nov. 29	1,489,088,657	259,004	Dec. 22	1,475,67
312,500	.....	Oct. 17	1,548,896,120	173,248	239,160	Aug. 28	1,198,926,369	238,480	Dec. 13	1,224,718,196	213,450	July 12	1,079,47
303,600	303,600	Dec. 5	1,360,017,300	155,300	254,700	Dec. 7	1,105,211,100	201,500	Nov. 23	897,980,200	218,800	June 16	1,002,30
299,438	289,200	Dec. 27	1,148,511,101	135,785	260,355	Dec. 14	956,910,225	213,570	Dec. 8	877,047,595	203,624	Nov. 23	910,32
282,654	280,500	Dec. 5	1,084,990,294	122,700	249,778	Dec. 18	958,407,194	213,502	Nov. 28	821,198,975	216,452	Nov. 16	912,89
156,500	156,500	July 26	1,122,750,450	128,168	135,600	Aug. 10	963,662,660	116,600	Jan. 1	572,277,989	159,700	Aug. 7	1,103,62
219,500	.....	Nov. 20	1,063,046,267	119,477	208,980	Dec. 13	858,329,336	164,240	Feb.	702,897,985	162,000	Jan. 29	810,40
270,800	.....	Dec. 11	1,001,026,319	114,272	233,000	July	910,488,432	218,300	Feb.	790,000,000	210,000	Nov.	745,87
181,000	.....	Dec. 18	945,691,000	108,000	137,354	Dec. 11	634,674,505	106,919	Dec. 2	516,829,636	104,618	Nov. 24	524,97
187,275	184,800	Dec. 20	802,859,991	91,651	181,112	Dec. 14	688,149,162	141,850	Dec. 15	564,819,267	155,041	Sept. 9	682,55
142,000	142,000	Dec. 13	707,087,842	80,718	127,000	Nov. 24	552,035,090	87,000	Nov. 2	415,153,634	88,000	Jan. 6	492,46
154,800	152,500	Dec. 20	707,958,270	80,800	142,000	Dec. 7	587,682,340	115,000	Nov. 14	479,862,700	108,500	Oct. 26	544,29
138,291	138,291	Nov. 27	553,624,392	63,427	134,482	Dec. 19	458,405,215	98,887	Nov. 22	375,354,892	90,347	Jan. 6	398,61
180,000	174,000	Dec. 20	598,808,757	68,357	164,495	Dec. 7	516,987,870	137,800	Dec. 6	438,887,775	116,500	Nov. 30	382,96
105,452	.....	Dec.	621,977,000	71,000	87,158	Dec. 19	428,912,903	75,661	Jan. 8	362,908,000	85,404	Nov.	519,85
149,196	144,989	Nov. 26	636,428,456	72,652									
138,410	.....	Dec. 19	678,346,746	77,437	138,800	Dec. 13	568,669,404	108,330	Nov. 30	415,335,614	88,990	Nov. 30	429,71
116,453	.....	Nov. :	602,691,800	68,800	106,987	Nov. 14	495,344,612	84,203	Sept. 27	442,507,974	87,685	Sept.	411,63
139,849	137,052	Sept. 18	574,031,472	65,529	116,130	Dec. 4	461,840,561	95,410	Dec. 12	397,815,027	106,924	May 19	476,09
139,314	.....	Oct. 23	575,067,581	65,647	125,460	Dec. 14	469,993,180	112,200	Nov. 9	405,979,457	103,450	Jan. 6	430,91
93,700	97,500	Mar. 5	460,097,505	52,500	82,700	Dec. 11	353,320,559	69,100	May 16	342,948,926	74,800	April 3 & June 4	482,64
153,123	.....	Dec. 10	526,465,178	60,099	133,594	Dec. 14	439,448,099	128,200	Dec. 15	375,025,955	105,090	Dec. 9	395,07
116,800	116,800	Dec. 12	589,597,024	65,673	105,910	Dec. 5	572,693,958	95,540	June 7	490,584,257	80,600	July 27	408,57
124,300	124,300	Dec. 19	577,578,440	65,933	105,600	Dec. 4	474,042,886	99,800	Dec.	419,197,581	95,725	Dec. 3	472,76
98,017	96,943	Dec. 4	427,460,666	48,797	82,737	Dec. 19	362,220,201	80,563	Dec. 30	415,940,095	.....	.....	.....
112,000	107,000	Dec. 20	438,386,388	50,044	100,000	Dec. 13	366,071,350	75,000	Dec. 14 & 23	281,537,273	65,050	Dec. 21	234,63
73,425	73,425	July 27	465,458,706	53,154	67,885	Aug. 4	451,390,040	61,700	June 27	396,174,690	47,180	Aug. 28	299,53
92,723	.....	Dec.	415,424,787	47,423	80,080	Nov.	316,838,000	.....	.....	.....	.....	.....	.....
86,487	84,955	Nov. 9	413,240,900	46,487	89,278	Dec. 12	407,657,100	70,110	Nov. 23	374,378,300	63,955	Jan. 21	351,08
85,000	84,400	Jan. 3	420,028,600	47,900	83,000	June 10	373,341,800	83,000	Nov.	419,987,000	85,000	.....	494,62
98,945	98,096	Dec. 13	426,337,964	48,669	75,275	Dec. 15	318,502,702	51,900	Dec. 21	300,353,806	46,500	Dec. 29	169,48
91,500	85,000	Oct. 4	358,353,618	40,800	80,000	Nov. 15	317,068,699	72,000	Nov. 3 & 28	282,084,977	76,000	April 9	293,72
81,500	81,800	Dec. 20	365,997,750	41,780	71,800	Dec. 28	324,116,190	64,800	Dec. 20	298,514,571	62,600	Dec. 6	292,31
61,100	61,100	Jan. 19	340,864,488	38,911	64,200	Nov. 20	276,936,464	45,300	Nov. 9	202,670,200	48,900	Nov. 3	255,53
41,600	41,000	Dec.	168,814,810	19,271	32,100	Nov. 20	127,315,007	27,900	Nov. 30	99,815,200	28,000	Aug. 10	133,99
50,300	.....	May 22	251,144,646	28,950									
73,000	73,000	Dec. 5	273,643,372	31,238	58,000	Dec. 14	215,785,945	46,700	Dec. 13	179,121,428	52,400	March	207,83
57,000	48,000	Jan.	182,281,000	20,808									
62,800	.....	Sept. 27	289,903,699	34,450	59,490	Dec. 6	253,305,000	50,531	Dec. 23	204,752,604	35,500	Dec. 23	175,93
43,439	43,439	Sept.	203,997,334	23,287	43,589	Dec.	163,902,506	31,885	April	132,788,852	.....	.....	.....
70,000	68,160	Dec. 27	269,870,850	30,807	70,000	Dec. 20	251,984,618	65,000	Dec. 14	238,028,571	62,000	Nov. 30	225,99
59,600	59,600	June 13	217,138,000	24,800	56,400	May 16	201,796,000	57,900	May 17	170,826,000	55,500	May 27	212,12
56,400	62,000	Dec. 18	262,940,313	30,000	54,250	Dec. 18	230,293,745	47,000	Dec. 14	208,323,000	46,150	Dec. 22	208,51
46,400	46,400	Dec. 10	259,720,216	29,100	43,000	Dec.	232,684,874	42,000	Oct. 12	187,249,647	44,400	May	247,10
61,824	56,124	Dec. 6	248,156,900	28,330	53,040	Nov. 23	193,503,573	48,734	Dec. 16	185,480,692	49,400	Oct. 29	193,60
47,800	.....	.....	244,600,000	27,900	42,600	Dec. 4	205,447,368	35,600	Dec. 19	154,500,000	35,300	Oct.	148,70
50,900	53,450	Dec. 5	196,432,892	22,400	45,706	Dec. 14	158,371,247	28,255	Nov. 28	101,129,915	33,392	Oct. 12	145,11
88,000	.....	Nov. 21	373,505,000	42,638	85,000	Dec. 4	297,400,000	72,000	Nov. 23	243,087,000	54,000	Jan. 5 & Nov. 6	213,23
58,500	57,000	Dec. 10	196,615,340	22,444	46,500	Dec. 8	159,836,687	37,500	Nov. 28	134,588,457	31,500	May 25 & Sept. 28	129,61
37,570	.....	Dec. 17	225,453,000	25,736	66,560	Dec. 13	183,536,613	33,620	Sept. 22	156,851,213	33,620	Oct. 14	159,93
40,100	.....	June 11	219,653,900	25,011	36,200	July 14	186,671,850	45,700	June 6 & Aug. 8	199,453,965	32,600	July 23	175,10
51,700	.....	Dec.	211,765,420	24,174	46,500	Dec. 13	188,000,000	.....	.....	.....	.....	.....	.....
34,510	.....	Oct. 19	261,577,017	29,860	32,449	Nov. 3	246,175,203	35,018	Aug. 14	258,249,673	35,408	Nov. 12	257,75
32,463	32,463	Nov. 20	153,590,531	17,523	27,695	Dec. 20	131,293,165	20,270	March 16	133,091,607	20,335	Jan. 28	143,02
42,300	42,300	Sept. 5	174,670,219	19,941	30,800	Oct.	128,345,120	26,300	Dec.	114,587,986	.....	.....	.....
35,202													

0	180,554,058	20,000	32,463	32,463	Nov. 20	153,500,531	17,523	27,695	Dec. 20	131,293,165	20,270	March 16	133,091,607	2
0	202,871,998	22,100	42,300	42,300	Sept. 5	174,670,219	19,941	30,800	Oct.	128,345,120	26,300	Dec.	114,587,986	
2	216,151,037	24,600	.....	.....	Dec.	145,302,874	16,587	28,800	Dec.	102,631,000	.....	.....	.....	
0	193,987,141	22,144	35,202	.....	Dec. 5	162,443,207	18,544	.....	.....	.....	.....	.....	.....	

d Distributing Companies

0 kw.-hr. during 1925

	1919			1918			1917			1916			
Output for Year Kw.-Hr. (27)	Peak Load Kw. (28)	Date of Peak Load (29)	Output for Year Kw.-Hr. (30)	Peak Load Kw. (31)	Date of Peak Load (32)	Output for Year Kw.-Hr. (33)	Peak Load Kw. (34)	Date of Peak Load (35)	Output for Year Kw.-Hr. (36)	Peak Load Kw. (37)	Date of Peak Load (38)	Output for Year Kw.-Hr. (39)	Line No. (1)
2,328,326,064	275,803	Dec. 29	2,034,608,904	254,139	Apr. 8	2,054,360,080	152,340	Aug. 1	1,188,221,770	143,360	Nov. 24	1,015,525,680	1
1,883,570,000	428,630	Dec. 15	1,883,570,000	400,010	Dec. 2	1,508,070,000	392,330	Dec. 28	1,488,080,000	369,740	Dec. 19	1,341,964,000	2
1,383,070,086	330,210	Nov. 25	1,104,521,883	286,103	Dec. 11	958,878,156	278,097	Dec. 12	954,913,584	254,824	Dec. 20	856,385,319	3
1,475,678,673	187,135	Dec. 19	994,557,418	166,705	June 4	922,037,604	158,272	Nov. 27	854,099,030	141,008	Dec. 19	768,304,907	4
1,079,474,091	200,020	July 23	1,021,977,519	163,125	July 12	779,758,000	166,755	Oct. 11	685,416,000	60,930	Dec. 28	299,950,513	5
1,002,306,000	210,000	Dec. 5	872,583,200	172,000	Dec. 13	773,876,700	152,300	Nov. 27	672,200,600	130,200	Dec. 19	546,925,300	6
910,327,693	199,247	Dec. 18	722,615,280	166,294	Dec. 6	693,447,962	148,931	Nov. 20	600,583,589	142,260	Dec. 12	444,785,884	7
912,899,972	207,890	Dec. 16	821,355,239	185,738	Dec. 5	795,481,279	181,500	Nov. 27	734,665,649	174,000	Dec. 14	608,018,729	8
1,103,620,644	133,500	June 13	865,998,552	157,800	Nov. 21	1,108,125,350	147,712	Jan. 11	947,732,014	149,740	Dec. 19	867,940,326	9
810,401,406	157,900	Dec. 22	623,000,000	141,000	Dec. 6	641,874,585	125,000	Nov. 9	592,575,925	101,000	Dec. 21	463,537,660	10
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12
745,873,992	196,500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13
524,976,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	14
682,557,097	153,878	Dec. 5	576,131,649	128,319	Nov. 22	543,663,042	113,228	Nov. 27	444,735,309	84,999	Oct. 25	340,670,721	15
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16
492,466,460	.....	Dec.	585,596,925	162,600	Dec.	551,313,367	166,300	May	563,533,763	.....	.....	.....	17
544,293,410	106,500	Nov. 22	508,583,680	104,100	Nov. 22	587,761,870	95,400	Dec. 6	440,596,100	65,500	Dec. 14	328,412,550	18
398,619,744	97,912	Dec. 4	331,874,192	87,855	Nov. 20	327,784,516	71,106	Nov. 30	275,966,740	64,170	Dec. 5	218,421,711	19
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20
382,963,027	105,400	Jan. 15	327,084,075	86,000	Dec. 11	282,424,822	78,000	Dec. 19	255,912,300	67,200	Dec. 19	233,452,500	21
519,854,000	79,725	Jan. 14	461,532,000	81,313	Dec. 27	533,044,000	79,011	Dec. 21	502,183,000	68,894	Dec. 6	412,726,000	22
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23
429,710,847	80,640	Dec. 5	392,201,280	82,760	Nov. 7	433,196,550	69,980	Dec. 4	343,523,580	55,620	Dec. 11	249,836,310	24
411,639,501	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	25
476,095,098	108,847	Nov. 28	456,230,164	98,666	Nov. 21	404,412,000	94,235	.....	380,570,917	.....	.....	315,964,337	26
430,918,000	93,860	Dec. 9	357,303,224	76,900	Dec. 16	323,127,784	71,500	Oct. 30	300,600,000	64,000	Dec. 12	246,000,000	27
482,649,835	82,300	Feb. 14	422,272,590	87,800	Dec. 11	519,959,383	85,200	June 15	547,945,475	81,650	Dec. 14	483,354,162	28
395,076,738	103,136	Dec. 8	328,798,850	95,774	Dec. 6	293,966,604	83,966	Dec. 19	265,430,474	80,539	Dec. 12	239,557,144	29
408,577,754	84,860	Aug. 1	453,353,358	75,480	Aug. 12	451,309,000	74,900	Oct. 6	457,998,635	74,100	Dec. 14	408,391,067	30
472,765,800	93,900	Dec. 18	452,209,000	88,230	Dec. 20	427,800,000	83,800	Dec. 21	396,600,000	77,030	Nov. 28	353,697,263	31
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	32
234,634,375	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	33
299,536,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	34
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	35
351,087,900	63,220	Dec. 3	241,761,350	33,956	Nov. 26	195,628,500	36,707	Dec. 20	188,311,100	30,440	Dec. 14	162,825,400	36
494,624,000	87,000	Nov.	512,138,100	89,000	Feb.	500,641,122	86,000	.....	516,891,000	77,000	.....	417,837,600	37
169,489,210	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	38
293,721,290	71,700	Dec. 18	262,834,541	68,000	Nov. 8	238,489,012	78,200	Apr. 24	258,607,882	72,600	Mar. 17	211,872,638	39
292,318,971	56,300	Dec. 22	271,600,300	56,900	Dec. 23	258,424,940	50,620	Dec. 31	218,086,315	47,335	Nov. 29	194,146,555	40
255,537,150	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	41
133,994,030	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	42
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	43
207,830,610	48,220	Dec.	199,771,799	40,305	Dec.	161,103,970	37,627	Dec.	162,061,232	36,428	Dec. 22	134,842,360	44
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45
175,939,618	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	46
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47
225,994,701	55,000	Dec. 17	204,008,647	48,000	Dec. 20	173,180,014	44,800	.....	140,762,646	38,600	Dec. 18	122,158,818	48
212,126,530	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	49
208,517,000	42,800	Dec. 18	125,840,000	35,700	Dec. 18	164,810,750	37,000	Dec. 18	153,128,026	33,900	Dec. 18	132,275,000	50
247,109,963	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	51
193,601,590	42,500	Dec. 2	172,892,249	52,300	Nov. 22	196,171,300	42,154	Dec. 13	162,490,264	40,250	Dec. 16	146,069,428	52
148,700,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	53
145,111,822	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	54
213,232,000	57,000	Dec. 23	155,678,890	45,000	June 20	150,028,780	33,500	Dec. 19	113,238,441	.....	.....	.....	55
129,618,270	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	56
159,939,831	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	57
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	58
175,104,808	29,200	.....	165,782,785	28,200	Au g. 6	161,347,690	25,900	Aug. 9	148,267,885	22,400	Apr. 28	131,084,265	59
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	60
257,752,195	35,794	Apr. 23	264,272,468	33,519	Dec. 24	233,381,654	32,990	Dec. 3	221,538,757	.....	.....	.....	61
143,025,818	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	62
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	63
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	64
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	65

32,463	32,463	Nov. 20	155,590,551	17,525	27,695	Dec. 20	131,293,163	20,270	March 16	115,091,887	28,000		
42,300	42,300	Sept. 5	174,670,219	19,941	30,800	Oct.	128,345,120	26,300	Dec.	114,587,986			
35,202													

56	Dayton Power and Light Company	56		73,500	70,000	Dec. 21	275,502,706	31,440		72,000	68,000	Dec. 12	
57	Texas Power and Light Company	57		57,830		Sept.	264,399,000	30,182		53,400		Sept. 4	
58	Central Indiana Power Company System	58		74,800	65,000	Dec. 8	262,971,086	30,050					
59	Southern Sierras Power Company (*P*)	59		49,900		July 16	260,300,140	29,715		40,500		June 7–Oct. 21	
60	New Orleans Public Service, Inc.	60		65,000		Dec.	252,735,340	28,857		56,000	55,000	Dec. 12	
61	Michigan Northern Power Company	61			(*q*) 33,084	(*n*) Aug. 22	252,186,398	28,788			(*r*) 30,297	(*r*) Dec. 9	
62	California Oregon Power Company	62	(*s*)	67,180	(*s*) 67,180	Oct. 20	(*t*) 251,310,788	(*s*) 28,613		36,222	36,222	Dec. 10	
63	Central Illinois Public Service Co.	63		65,000	61,350	Nov. 18	247,311,779	28,250		53,500	53,500	Dec. 30	
64	Public Service Co. of Colorado	64		58,645	57,900	Dec. 22	244,055,341	27,900		55,000	52,000	Dec. 22	
65	Birmingham Electric Company	65		35,919		Dec.	224,109,866	25,582		37,749		Dec. 10	
66	Seattle Municipal Lt. & Power System	66		59,600	56,000	Dec. 29	218,245,950	24,920		50,800	49,500	Dec. 9	
67	Louisville Gas and Electric Company	67		56,250	52,000	Dec. 8	217,377,479	24,400		48,700	43,100	Dec. 23	
68	New York and Queens El. Lt. & Pwr. Co. (*O*)	68		61,300	59,312	Dec. 22	209,748,985	23,940		48,900	46,800	Dec. 3	
69	Penn Central Light and Power Company	69		46,300	46,250	Dec. 14	208,994,394	23,858		40,100	39,950	Dec. 30	
70	Columbus Electric and Power Company	70		52,040	49,300	Nov. 4	204,811,841	23,400		38,910		Dec. 5	
71	Houston Lighting and Power Company	71		39,250		Dec.	199,847,650	22,813		33,100		Nov. 25	
72	Idaho Power Company	72		38,555		Aug.	198,959,000	22,712		48,238		May	
73	Scranton Electric Company	73		46,300	42,800	Aug. 6	197,864,432	22,620			39,800	Dec. 23	
74	Northwestern Electric Company	74		39,300		Dec.	196,911,791	22,478	(*B*)	34,500	(*o*) 33,400		
75	Indianapolis Light and Heat Company	75		48,237		Dec. 16	196,762,929	22,470		45,544	45,544	Dec. 18	
76	Syracuse Lighting Company	76			41,127	(*n*) Oct. 6	193,244,088	22,100			(*r*) 38,900	Dec. 17	
77	Hartford Electric Light Company	77		56,400	52,000	May 1	190,355,000	21,750		54,700	52,000	Nov. 19	
78	Los Angeles Gas and Electric Corp	78		58,300	58,300	Dec. 17	184,683,171	21,069		69,000	69,000	Nov. 5	
79	Fort Worth Power and Light Company	79		51,500		Dec.	183,622,525	20,961		50,000		Dec. 31	
80	Indiana and Michigan Electric Co.	80	(*b*)	58,390	60,000	(*o*) Dec. 1	180,932,804	20,600	(*o*)	33,300	36,600	(*o*) Dec. 11	
81	Empire District Electric Company	81	(*u*)	59,260		Jan. 1	178,047,098	20,340		41,200		Dec. 17	
82	Kansas Gas and Electric Company	82		35,800		Dec.	177,590,200	20,272		35,200		Dec.	
83	Nebraska Power Company	83		30,500		Oct.	177,233,500	20,230		34,700		Dec. 18	
84	Central Maine Power Company	84	(*r*)	628,410		(*v*) Dec. 30	174,943,577	20,000			(*o*) 33,300		
85	Northern Indiana Gas and Elec. Co.	85		32,796	30,500	Dec. 22	170,852,661	19,450		28,800		(*D*) Dec. 23	
86	Consolidated Power and Light Company	86		34,200		Oct. 14	164,351,647	18,770		29,500	27,700		
87	Carolina Power and Light Company	87		46,000		Nov.	160,646,601	18,338		25,000		Dec.	
88	Potomac Edison Company	88			35,040	Sept. 16	158,537,000	18,098			30,115	Dec. 11	
89	City of Tacoma Light Department	89		33,000	32,500	Dec. 29	157,662,360	17,997		33,400	32,000	Dec. 19	
90	Oklahoma Gas and Elect. Company System	90		45,000	40,000	Nov. 24	156,979,298	17,930		36,456	32,000	Nov. 15	
91	Pacific Power and Light Company	91	(*i*)	35,000		Aug.	155,585,707	17,760					
92	New Bedford Gas and Edison Lt. Co.	92		50,300	49,000	Dec. 1	155,470,639	18,060		48,800	46,000	Dec. 22	
93	Cleveland Department Light and Power	93			31,000	Dec. 21	151,475,140	17,280					
94	Virginian Power Company	94								50,500	47,000	March 10	
95	Oil Belt Power Company	95		23,300		Dec.	147,218,200	16,805					
96	United Light and Power Company	96								37,110	31,860	Dec.	
97	Yadkin River Power Company	97		45,000		Jan.	144,950,100	16,546		48,600		Dec. 30	
98	Dallas Power and Light Company	98		36,400		Dec.	144,739,433	16,522		31,700		Dec. 22	
99	Blackstone Valley Gas & Elec. Co.	99		48,000	46,700	Dec. 21	138,876,293	15,853	(*o*)	41,440	45,000	Dec. 18	
100	York Haven Water and Power Co.	100		17,400	17,000	Nov. 28	138,525,000	15,820		15,700	15,700	July 23	
101	Wisconsin Public Service Corp.	101		30,400	29,000	Dec. 4	(*w*) 128,835,193	14,700		35,000	30,000	Dec.	
102	Western States Gas & Elect. Co.	102		36,244	32,602		128,571,450	14,693			28,500		
103	Metropolitan Power Company	103		36,000	36,000	July 9	122,851,000	14,030					
104	Memphis Power and Light Company	104		34,300		Dec.	121,627,000	13,872		31,700	30,800	Dec. 22	
105	Edison Electric Company	105	(*x*)	30,300		(*y*)	118,617,000	13,541	(*B*)	26,400		Dec. 10	
106	San Diego Consol. Gas & Elect. Co.	106		27,300	26,000	Dec. 18	117,956,180	13,465					
107	Worcester Electric Light Company	107		38,900	31,200	Feb. 4	108,822,300	12,423					
108	Moline-Rock Island and Mfg. Company	108		30,000	28,000	Dec. 4	108,316,069	12,400					
109	Central Illinois Light Company	109		25,800	(*m*) 24,897	Sept. 30	106,992,465	12,230					
110	Westchester Lighting Company (*O*)	110	(*A*)	30,000	(*A*) 28,100	Dec. 21	(*A*) 104,207,062	(*A*) 11,900					
							56,060,809,373						
	Canada												
111	Hydro-Electric Power Com. of Ontario (*R*)	1		635,485	(*O*) 628,985	Dec. 8	3,298,347,874	376,409		576,403	567,853	Dec. 22	
112	Shawinigan Water and Power Company	2		371,002	371,002	Nov. 24	2,421,046,311	276,000		347,448	347,448	Nov. 7	
113	Montreal Light, Heat and Power Consol.	3		233,230	233,230	Dec. 9	1,175,430,654	134,182		221,060	220,000	Dec. 24	
114	British Columbia Electric Ry. Co., Ltd.	4		83,100	78,400	Dec. 22	336,907,650	38,460		75,200	70,900	Dec. 9	
115	City of Winnipeg Hydro Electric Systems	5		60,321	59,480	Dec. 31	261,996,380	29,270		46,065	46,065	Oct. 28	
116	Winnipeg Electric Company	6		61,100	56,100	Jan.	252,891,600	28,850					
117	Kaministiqua Power Company, Ltd.	7		28,000	25,300	Sept. 30	107,576,036	12,290					
							7,854,196,505						
	Electric Railways												
118	Interborough Rapid Transit Company	1			276,380	Jan. 23	1,063,504,660	121,405			272,760	Jan. 26	
119	Chicago Surface Lines	2	(*i*)	200,000	(*o*) 185,319	Feb. 27	630,560,494	69,436			(*o*) 185,866	Dec. 23	
120	Williamsburgh Power Plant Corp.	3	(*o*)	132,300	138,000	Dec. 23	508,481,425	58,046	(*o*)	132,200	138,000	Dec. 26	
121	Philadelphia Rapid Transit Co.	4			116,160	Jan. 28	385,707,158	44,030			120,885	Jan. 21	
122	Pennsylvania Railroad Company (L. I.)	5		98,000	79,600	Jan. 2	266,137,403	30,380		96,300	(*o*) 75,400	Dec. 26	
123	Boston Elevated Railways Company	6		94,226	89,943	Jan. 28	247,490,105	28,252		94,869	90,557	Jan. 21	
124	New York, New Haven and Hartford R.R.	7		40,000	(*o*) 31,300	Dec. 10	209,542,400	14,914					
125	New York Central Railroad Company	8	(*i*)	70,000	(*o*) 60,310	Dec. 28	184,775,459	21,100		62,500		Dec. 24	
126	Pacific Electric Railway Company	9	(*o*)	44,000	50,000	Dec. 15	183,000,000	20,900		50,000	(*o*) 44,000	April 3	
127	Twin City Rapid Transit Company	10			24,460		144,413,357	16,500					
						Dec. 15							
128	Chicago, Milwaukee & St. Paul Railway	11					136,993,694	15,500					
129	Kansas City Railways Company	12		43,000	40,500	Jan. 27-Dec. 22	127,740,470	14,582		43,000	40,820	Dec. 18	
							4,088,346,625						

(*a*) Actual over thirty-minute period.
(*b*) Actual over one-hour period.
(*c*) Estimated over one-hour period.
(*d*) Includes 12,500 kw. joint operation with Commonwealth Edison Company.
(*e*) Includes 13,920 kw. joint operation with Commonwealth Edison Company.
(*f*) Includes 24,239,872 kw.-hr. joint operation with Commonwealth Edison Company.
(*g*) Includes 2,767 kw. joint operation with Commonwealth Edison Company.
(*h*) Estimated over fifteen-minute p
(*i*) Estimated.
(*k*) Kva.
(*l*) System fifteen-minute period.
(*m*) Over fifteen-minute period.
(*n*) Over thirty-minute period.
(*o*) Over one-hour period.
(*p*) Includes also Nevada-California Water Oil & Irrigation Company

50,5													
88,000		Nov. 21	373,505,000	42,638	85,000	Dec. 4	297,400,000	72,000	Nov. 23	243,087,000	54,000	Jan. 5 & Nov. 6	2[illegible],[illegible]2,00

63														
64														
65														
. 12	249,330,663	29,062	58,500	57,000	Dec. 10	196,615,340	22,444	46,500	Dec. 8	159,836,687	37,500	Nov. 28	134,588,457
t. 4	262,187,000	29,917	37,570	.....	Dec. 17	225,453,000	25,736	66,560	Dec. 13	183,536,613	33,620	Sept. 22	156,851,213
Oct. 21	226,680,958	25,806	40,100	.....	June 11	219,653,900	25,011	36,200	July 14	186,671,850	45,700	June 6 & Aug. 8	199,453,965
. 12	226,504,380	26,000	51,700	.....	Dec.	211,765,420	24,174	46,500	Dec. 13	188,000,000	.....	.....	.....
ec. 9	258,750,604	29,457	34,510	.....	Oct. 19	261,577,017	29,860	32,449	Nov. 3	246,175,203	35,018	Aug. 14	258,249,673
. 10	180,554,058	20,000	32,463	32,463	Nov. 20	153,590,531	17,523	27,695	Dec. 20	131,293,165	20,270	March 16	133,091,607
. 30	202,871,998	22,100	42,300	42,300	Sept. 5	174,670,219	19,941	30,800	Oct.	128,345,120	26,300	Dec.	114,587,986
. 22	216,151,037	24,600	.....	.....	Dec.	145,302,874	16,587	28,800	Dec.	102,631,000	.....	.....	.....
. 10	193,987,141	22,144	35,202	.....	Dec. 5	162,443,207	18,544	.....	.....	.....	.....	.....	.....
c. 9	152,125,000	17,250	35,600	34,500	Dec. 7	115,431,550	13,150	.....	.....	.....	.....	.....	.....
. 23	168,403,952	19,200	40,650	39,583	Dec. 5	143,749,060	16,409	35,300	Nov. 15	120,011,093	.....	.....	.....
c. 3	183,091,200	21,809	45,100	42,000	Dec. 4	160,754,592	19,201	39,500	Dec. 13	136,850,900	32,500	Dec. 7	112,472,748
. 30	165,364,793	18,761	36,100	35,700	Dec. 20	147,423,930	16,890	.....	.....	.....	.....	.....	.....
c. 5	156,732,805	(i) 34,010	36,310	36,310	Oct. 16	160,246,106	18,293	.....	.....	.....	.....	.....	.....
. 25	161,307,120	18,528	27,400	.....	Dec. 3	129,318,120	14,762	24,200	Nov. 22	.....	.....	.....	.....
ay	218,464,000	24,939	40,016	.....	Aug.	222,590,000	25,410	38,323	July 24	212,237,000	35,635	Sept. 1	190,215,255
. 23	164,162,797	18,700	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	188,771,500	20,200	30,900	31,000	Dec. 19	152,702,800	17,411	22,700	Dec. 29	120,698,840	22,190	Dec. 12	113,913,335
c. 18	181,810,339	20,754	39,478	39,478	May 8–11	169,453,319	19,350	38,326	Dec. 14	138,356,280	29,350	Nov. 9	108,829,278
. 17	157,309,967	18,000	38,071	37,200	Nov.	159,670,385	18,227	33,686	Dec. 8	124,457,748	.....	.....	.....
. 19	163,178,438	18,600	60,200	58,500	{Oct.23–Nov. 22}	181,202,880	20,685	56,000	Dec. 14	134,000,000	31,700	Nov. 14	97,754,000
v. 5	245,047,430	27,883	43,500	43,500	Dec. 18	127,357,201	14,563	.....	.....	.....	.....	.....	.....
. 31	257,757,000	29,413	45,067	.....	Dec. 18	240,662,700	27,472	38,500	Dec. 21	178,790,374	29,500	Oct. 15	163,286,500
ec. 11	133,329,990	15,200	37,970	41,500	May 8	156,333,990	17,846	37,450	Dec. 4	136,825,060	28,280	Dec. 16	105,593,490
. 17	148,402,996	17,143	58,826	.....	May	152,681,540	17,400	.....	.....	.....	.....	.....	.....
ec.	163,783,700	18,697	33,000	.....	Dec. 3	160,464,200	18,300	29,600	Dec. 7	139,167,200	25,000	Dec.	130,479,900
. 18	166,110,700	18,961	34,000	.....	Dec. 19	160,624,600	18,335	30,200	Dec. 6	140,272,500	28,200	Oct. 28	127,758,800
.....	154,117,396	17,550	32,200	.....	Dec. 3	146,136,310	16,700	32,500	Dec. 11	128,445,449	.....	.....	.....
ec. 23	149,220,978	17,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	131,059,700	12,966	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
ec.	100,538,848	11,479	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
. 11	141,946,221	16,100	25,450	.....	Sept. 25	112,820,766	12,879	.....	.....	.....	.....	.....	.....
. 19	147,218,203	16,757	29,600	29,600	Dec. 7	136,757,822	15,611	31,900	Dec. 5	112,546,832	28,400	Dec. 20	95,697,600
. 15	129,946,323	18,100	30,850	.....	Dec.	108,364,544	.....	.....	.....	.....	.....	.....	.....
.....	137,304,890	15,680	25,000	.....	Sept.	116,676,395	13,319	.....	.....	.....	.....	.....	.....
. 22	121,512,151	14,095	47,782	45,500	Jan. 3	133,707,946	15,280	47,500	Dec. 18	115,938,294	40,300	Dec. 21	89,857,700
ch 10	148,012,957	17,800	47,645	.....	Dec.	163,147,137	18,624	.....	.....	.....	.....	.....	.....
ec.	136,285,527	15,498	34,785	.....	Dec. 4	146,987,476	16,800	35,505	.....	129,236,964	.....	.....	.....
. 30	144,412,100	16,485	48,600	.....	Dec.	165,846,240	18,932	37,000	Nov. 8	142,161,182	.....	.....	.....
. 22	127,924,350	14,603	16,300	.....	Dec. 3	105,400,728	12,032	.....	.....	.....	.....	.....	.....
. 18	124,813,962	(o) 14,209	40,060	43,500	Dec. 10	126,621,397	14,430	38,030	Dec. 20	110,225,488	.....	.....	.....
y 23	121,334,269	13,800	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
ec.	113,239,516	12,900	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	140,899,810	16,000	24,336	.....	June	114,597,745	.....	.....	.....	.....	.....	.....	.....
. 22	112,743,000	14,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
. 10	107,440,900	12,250	24,600	24,600	Nov. 27	100,205,700	11,439	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
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.....	44,244,126,939	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
. 22	3,026,615,156	344,560	520,084	.....	Nov. 27	2,906,519,819	331,795	46,471	Dec. 13	2,392,092,267	.....	.....	.....
v. 7	2,066,066,762	235,000	272,500	272,500	Nov. 7	1,667,397,876	190,342	250,000	Dec. 19	1,383,390,773	160,500	Dec. 19	863,124,240
. 24	1,157,648,660	150,000	197,565	197,565	Nov. 8	1,089,099,507	124,326	185,500	Nov. 27	945,206,656	165,900	Nov. 16	907,237,573
c. 9	300,456,350	34,298	32,700	33,700	Dec. 29	129,548,600	14,789	.....	.....	.....	27,200	March 1	122,684,800
. 28	200,520,080	22,700	39,835	39,600	Nov. 20	164,609,860	18,800	38,048	Dec. 11	144,509,000	34,264	Nov. 23	125,124,855
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	6,751,307,008	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
. 26	1,019,620,637	116,073	254,850	261,950	March 29	960,340,481	109,625	246,770	Jan. 24	886,223,920	242,760	Dec. 30	846,487,668
c. 23	604,581,618	68,828	170,485	.....	Dec. 13	576,457,379	60,205	.....	.....	735,246,576	.....	.....	712,683,840
c. 26	478,911,990	54,521	126,200	131,000	Jan. 17	449,827,260	51,314	118,800	Jan. 24	413,992,125	116,000	Dec. 22	383,009,325
. 21	371,519,687	42,295	115,154	115,154	Jan. 17	383,313,078	43,757	110,446	Dec. 19	346,506,580	105,303	Dec. 22	333,222,786
c. 26	244,345,733	29,000	70,600	70,600	Feb. 15	244,113,039	26,551	72,000	Dec. 30	214,906,725	64,000	Dec. 30	201,922,210
. 21	261,091,060	29,723	82,965	86,000	Dec. 19	257,983,320	29,382	78,755	Dec. 13	240,547,615	25,905	Jan. 18	223,061,330
c. 24	173,938,625	19,850	47,120	.....	Jan. 25	163,895,940	18,709	48,470	Jan. 3	157,450,819	50,750	Dec. 23	149,275,239
ril 3	185,000,000	21,000	43,000	43,000	Dec. 21	198,211,000	22,627	.....	.....	.....	.....	.....	.....
.....	143,000,000	16,280	51,218	59,000	Feb. 13	146,605,919	16,736	47,005	Dec. 14	145,675,337	44,599	Feb. 8	145,517,164
.....	(i) 116,974,186	.....	.....	.....	.....	122,643,791	.....	.....	.....	.....	.....	.....	.....
c. 18	129,383,860	14,730	42,600	.....	Feb. 14	128,302,450	14,647	40,200	Dec. 12	123,830,190	43,500	Jan. 13	129,804,772
.....	3,728,367,396	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

en-minute period.

e period.
period.
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d.
a-California Power Company and Desert
n Company.

(q) (r) Over eight-hour period.
(s) Includes Keno plant, operated under lease.
(t) Includes 214,560 kw.-hr. not billed to the company.
(u) Includes Ozark Power & Water Company.
(v) Maximum daily kilowatt-hours.
(w) At busbar.
(x) Over five-minute period, 25-cycle system, 12,500 kw.; 60-cycle system 17,800 kw.
(y) 25-Cycle system Dec. 2; 60-cycle system Dec. 9.

(A) Includes North Westchester Lighting Company and Peekskill Lighting & Railroad Company.
(B) Over five-minute period.
(D) Includes 11,000 kw. joint operation with Commonwealth Edison Company.
(E) Includes 50,961,607 kw.-hr. joint generation with Commonwealth Edison Company.
(I) Average of monthly average daily peaks.
(J) Northern division; 5,400 kw. must be added for Southern division.

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50,5													
88,000	.....	Nov. 21	373,505,000	42,638	85,000	Dec. 4	297,400,000	72,000	Nov. 23	243,087,000	54,000	Jan. 5 & Nov. 6	2[illegible]
58,500	57,000	Dec. 10	196,615,340	22,444	46,500	Dec. 8	159,836,687	37,500	Nov. 28	134,588,457	31,500	May 25 & Sept. 28	129,618,
37,570	.....	Dec. 17	225,453,000	25,736	66,560	Dec. 13	183,536,613	33,620	Sept. 22	156,851,213	33,620	Oct. 14	159,939,
40,100	.....	June 11	219,653,900	25,011	36,200	July 14	186,671,850	45,700	June 6 & Aug. 8	199,453,965	32,600	July 23	175,104,
53,700		Dec.	211,765,420	24,174	46,500	Dec. 13	188,000,000						
34,510	.....	Oct. 19	261,577,017	29,860	32,449	Nov. 3	246,175,203	35,018	Aug. 14	258,249,673	35,408	Nov. 12	257,752,
32,463	32,463	Nov. 20	153,590,531	17,523	27,695	Dec. 20	131,293,165	20,270	March 16	133,091,607	20,335	Jan. 28	143,025,
42,300	42,300	Sept. 5	174,670,219	19,941	30,800	Oct.	128,345,120	26,300	Dec.	114,587,986	.....	.....	.....
.....	.....	Dec.	145,302,874	16,587	28,800	Dec.	102,631,000	.....	.....	.....	.....	.....	.....
35,202	.....	Dec. 5	162,443,207	18,544	.....	.....	.....	.....	.....	.....	.....	.....	.....
35,600	34,500	Dec. 7	115,431,550	13,150	.....	.....	.....	.....	.....	.....	.....	.....	.....
40,650	39,583	Dec. 5	143,749,060	16,409	35,300	Nov. 15	120,011,093	.....	.....	.....	.....	.....	.....
45,100	42,000	Dec. 4	160,754,592	19,201	39,500	Dec. 13	136,850,900	32,500	Dec. 7	112,472,748	.....	.....	.....
36,100	35,700	Dec. 20	147,423,930	16,890	.....	.....	.....	.....	.....	.....	.....	.....	.....
36,310	36,310	Oct. 16	160,246,106	18,293	.....	.....	.....	.....	.....	.....	.....	.....	.....
27,400	.....	Dec. 3	129,318,120	14,762	24,200	Nov. 22	.....	.....	.....	.....	.....	.....	.....
40,016	.....	Aug.	222,590,000	25,410	38,323	July 24	212,237,000	35,635	Sept. 1	190,215,255	34,235	July	184,843,
30,900	31,000	Dec. 19	152,702,800	17,411	22,700	Dec. 29	120,698,840	22,190	Dec. 12	113,913,335	20,600	Dec. 10	112,736,
39,478	39,478	May 8–11	169,453,319	19,350	38,326	Dec. 14	138,356,280	29,350	Nov. 9	108,829,278	27,240	Sept. 15	114,416,
38,071	37,200	Nov.	159,670,385	18,227	33,686	Dec. 8	124,457,748	.....	.....	.....	.....	.....	.....
60,200	58,500	{Oct.23– {Nov. 22	181,202,880	20,685	56,000	Dec. 14	134,000,000	31,700	Nov. 14	97,754,000	32,500	Jan. 9	103,000,
43,500	43,500	Dec. 18	127,357,201	14,563	.....	.....	.....	.....	.....	.....	.....	.....	.....
45,067	.....	Dec. 18	240,662,700	27,472	38,500	Dec. 21	178,790,374	29,500	Oct. 15	163,286,500	.....	.....	.....
37,970	41,500	May 8	156,333,990	17,846	37,450	Dec. 4	136,825,060	28,280	Dec. 16	105,593,490	27,130	Nov. 9	103,693,
58,826	.....	May	152,681,540	17,400	.....	.....	.....	.....	.....	.....	.....	.....	.....
33,000	.....	Dec. 3	160,464,200	18,300	29,600	Dec. 7	139,167,200	25,000	Dec.	130,479,900	.....	.....	.....
34,000	.....	Dec. 19	160,624,600	18,335	30,200	Dec. 6	140,272,500	28,200	Oct. 28	127,758,800	25,500	Nov. 26	114,200,
32,200	.....	Dec. 3	146,136,310	16,700	32,500	Dec. 11	128,445,449	.....	.....	.....	.....	.....	.....
25,450	.....	Sept. 25	112,820,766	12,879	.....	.....	.....	.....	.....	.....	.....	.....	.....
29,600	29,600	Dec. 7	136,757,822	15,611	31,900	Dec. 5	112,546,832	28,400	Dec. 20	95,697,600	22,700	Nov. 10	120,598,
30,850	.....	Dec.	108,364,544	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25,000	.....	Sept.	116,676,395	13,319	.....	.....	.....	.....	.....	.....	.....	.....	.....
47,782	45,500	Jan. 3	133,707,946	15,280	47,500	Dec. 18	115,938,294	40,300	Dec. 21	89,857,700	33,700	June 17	107,599,
47,645	.....	Dec.	163,147,137	18,624	.....	.....	.....	.....	.....	.....	.....	.....	.....
34,785	.....	Dec. 4	146,987,476	16,800	35,505	.....	129,236,964	.....	.....	.....	.....	.....	.....
48,600	.....	Dec.	165,846,240	18,932	37,000	Nov. 8	142,161,182	.....	.....	.....	.....	.....	.....
16,300	.....	Dec. 3	105,400,728	12,032	.....	.....	.....	.....	.....	.....	.....	.....	.....
40,060	43,500	Dec. 10	126,621,397	14,430	38,030	Dec. 20	110,225,488	.....	.....	.....	.....	.....	.....
24,336	.....	June	114,597,745	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24,600	24,600	Nov. 27	100,205,700	11,439	.....	.....	.....	.....	.....	.....	.....	.....	.....
520,084	.....	Nov. 27	2,906,519,819	331,795	46,471	Dec. 13	2,392,092,267	.....	.....	.....	.....	.....	.....
272,500	272,500	Nov. 7	1,667,397,876	190,342	250,000	Dec. 19	1,383,390,773	160,500	Dec. 19	863,124,240	192,200	Nov. 17	1,140,759,
197,565	197,565	Nov. 8	1,089,099,507	124,326	185,500	Nov. 27	945,206,656	165,900	Nov. 16	907,237,573	169,450	Nov. 17	900,328,
32,700	33,700	Dec. 29	129,548,600	14,789	.....	.....	.....	27,200	March 1	122,684,800	.....	.....	.....
39,835	39,600	Nov. 20	164,609,860	18,800	38,048	Dec. 11	144,509,000	34,264	Nov. 23	125,124,855	.....	.....	.....
254,850	261,950	March 29	960,340,481	109,625	246,770	Jan. 24	886,223,920	242,760	Dec. 30	846,487,668	242,020	Jan. 31	816,603,
170,485	.....	Dec. 13	576,457,379	60,205	.....	.....	735,246,576	.....	.....	712,683,840	.....	.....	.....
126,200	131,000	Jan. 17	449,827,260	51,314	118,800	Jan. 24	413,992,125	116,000	Dec. 22	383,009,325	111,147	Jan. 15	389,784,
115,154	115,154	Jan. 17	383,313,078	43,757	110,446	Dec. 19	346,506,580	105,303	Dec. 22	333,222,786	102,210	Jan. 14	349,027,
70,600	70,600	Feb. 15	244,113,039	26,551	72,000	Dec. 30	214,906,725	64,000	Dec. 30	201,922,210	55,200	Jan. 5	199,737,
82,965	86,000	Dec. 19	257,983,320	29,382	78,755	Dec. 13	240,547,615	25,905	Jan. 18	223,061,330	72,295	Jan. 14	246,212,
47,120	.....	Jan. 25	163,895,940	18,709	48,470	Jan. 3	157,450,819	50,750	Dec. 23	149,275,239	46,440	Dec. 27	157,132,
43,000	43,000	Dec. 21	198,211,000	22,627	.....	.....	.....	.....	.....	.....	.....	.....	.....
51,218	59,000	Feb. 13	146,605,919	16,736	47,005	Dec. 14	145,675,337	44,599	Feb. 8	145,517,164	42,700	Dec. 21	139,711,
.....	.....	.....	122,643,791	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
42,600	.....	Feb. 14	128,302,450	14,647	40,200	Dec. 12	123,830,190	43,500	Jan. 13	129,804,772	51,740	Jan. 8	189,172,

(*q*) (*r*) Over eight-hour period.
(*s*) Includes Keno plant, operated under lease.
(*t*) Includes 214,560 kw.-hr. not billed to the company.
(*u*) Includes Ozark Power & Water Company.
(*v*) Maximum daily kilowatt-hours.
(*w*) At busbar.
(*x*) Over five-minute period, 25-cycle system, 12,500 kw.; 60-cycle system 17,800 kw.
(*y*) 25-Cycle system Dec. 2; 60-cycle system Dec. 9.

(*A*) Includes North Westchester Lighting Company and Peekskill Lighting & Railroad Company.
(*B*) Over five-minute period.
(*D*) Includes 11,000 kw. joint operation with Commonwealth Edison Company.
(*E*) Includes 50,961,607 kw.-hr. joint generation with Commonwealth Edison Company.
(*I*) Average of monthly average daily peaks.
(*J*) Northern division; 5,400 kw. must be added for Southern division.

(*K*) Northern division; Dec. 18 for Souther
(*L*) Generated peak estimated over thirty-m
including purchased power totaled 54,900
(*M*) Estimated over twenty-minute period.
(*N*) Includes New York Edison Compa
Light & Power Company, New York & C
& Power Company and the Westchester
(*O*) Also included under Edison-United Co
(*P*) Includes Union Electric Light & Power

285,252,000	57,000	Dec. 23	[illegible]	[illegible]	June 26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
129,618,270													56
159,939,831													57
													58
175,104,808	29,200		165,782,785	28,200	Au g. 6	161,347,690	25,900	Aug. 9	148,267,885	22,400	Apr. 28	131,084,265	59
													60
257,752,195	35,794	Apr. 23	264,272,468	33,519	Dec. 24	233,381,654	32,990	Dec. 3	221,538,757				61
143,025,818													62
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184,843,000													72
													73
112,736,089													74
114,416,090													75
													76
103,000,000													77
													78
													79
103,693,910													80
	32,030	Oct.	130,114,100	25,400	Sept. 5	114,446,685	123,000	Apr. 1	105,487,860	26,900	Mar. 26	119,280,363	81
													82
114,200,500													83
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120,598,174													89
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107,599,392													92
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1,140,759,076	172,900	Jan. 14	1,031,111,695	136,800	Sept. 24	1,058,136,117	119,000	Dec. 21	633,573,610	108,000	Dec. 14	478,540,000	112
900,328,757	164,415	Dec. 16	852,680,550	166,730	Dec. 6	976,462,529	152,665	Nov. 12	946,832,817				113
													114
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													116
													117
816,603,610	239,940	Dec. 19	810,158,475	204,000	Dec. 30	731,058,965	184,000	Dec. 11	689,665,975				118
													119
389,784,451	110,000	Dec. 16	406,130,443	109,892	Feb. 21	385,346,075	115,792	Feb. 2	396,068,887				120
349,027,334	101,120	Dec. 18	349,542,666	94,730	Dec. 27	339,232,739	103,220	Jan. 11	348,372,056				121
199,737,907	53,900	Dec. 19	181,017,940	48,600	Jan. 3	165,377,180	45,000	Dec. 10	161,673,710				122
246,212,170	71,760	Mar. 23	240,429,915	67,965	Mar. 23	228,131,265	79,535	Feb. 12	262,920,065				123
													124
157,132,366	44,100	Dec. 29	140,435,406	38,360	Jan. 22	127,412,457	42,480	Dec. 10	147,809,842				125
													126
139,711,248	42,612	Nov. 28	133,676,028	44,966	Feb. 19	131,351,288	51,956	Mar. 31	152,469,348				127
													128
189,172,898	49,430	Oct. 27	211,707,571	57,280	Jan. 11	209,378,747	61,350	Feb. 2	236,675,814				129

for Southern division.
ver thirty-minute; system, peak,
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ute period.
on Company, United Electric
v York & Queens Electric Light
Vestchester Lighting Company.
-United Companies.
t & Power Company (Missouri)
Union Electric Light & Power Company of Illinois, East St. Louis & Suburban Company, and Mississippi River Power Co.
(*Q*) Includes Milwaukee Electric Railway & Light Company, Wisconsin Gas & Electric Company, Wells Power Company, Badger Public Service Company, Wisconsin Traction, Light & Power Company Peninsular Power Company, Milwaukee Northern Railway Company, and Wisconsin Electric Power Company.
(*R*) Includes Ontario Power Company and Toronto Power Co

Table II—Detailed Data on Generator Ratin
All Companies Having an

Line No.	Section and System	Generator Rating, Jan. 1, 1926				Generated and Purchased Output, 1925		
		Fuel Burning Plants		Hydro Plants		Total Output, Kw.-Hr.	Generated, Kw.-Hr.	Purchased Kw.-Hr.
		No. of Plants	Rating of Generators, Kva.	No. of Plants	Rating of Generators, Kva.			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	New England States							
1	New England Power Company	1	17,900	7	134,860	681,696,046	442,020,978	239,675,068
2	Edison Electric Illuminating Company of Boston	3	283,417	0	0	648,078,358	628,358,500	19,719,858
3	Turners Falls Power and Light Company	1	37,500	3	67,500	317,772,280	289,628,980	28,143,300
4	Connecticut Light and Power Company	2	94,600	2	30,600	287,165,218	267,831,280	19,333,938
5	Narragansett Electric Lighting Company	1	133,375	0	0	278,445,000	263,948,000	14,447,000
6	Hartford Electric Light Company	.....	76,000	.....	2,000	190,355,000	145,310,000	45,045,000
7	Central Maine Power Company	2	16,875	22	49,035	174,943,577	173,652,900	1,290,677
8	New Bedford Gas and Edison Light Company	1	115,000	0	0	155,470,639	155,470,639	0
9	Blackstone Valley Gas and Electric Company	2	(a) 36,650	3	(a) 1,750	138,876,293	62,377,834	76,498,459
10	Worcester Electric Light Company	1	71,225	0	0	108,822,300	99,148,100	9,674,200
	Totals for section	14	889,092	37	286,055	2,981,624,711	2,527,747,211	453,827,500
	Middle Atlantic States							
11	Niagara Falls Power Company	0	0	3	597,590	3,161,130,010	3,161,130,010	0
12	Edison-United Companies (*nn*)	7	(a) 891,000	0	0	2,262,620,409	2,262,538,609	81,800
13	Philadelphia Electric Company System	6	(a) 522,750	0	0	1,521,639,979	1,521,639,979	0
14	Public Service Electric and Gas Company	13	447,550	0	0	1,358,318,172	1,261,818,387	96,499,785
15	Duquesne Light Company	5	382,200	0	0	1,230,292,597	1,227,967,150	2,325,447
16	West Penn System	12	(a) 331,365	2	(a) 210	1,090,203,588	1,089,054,730	1,148,858
17	Niagara, Lockport and Ontario Power Company	3	35,200	2	32,000	872,402,171	108,310,730	764,091,441
18	Buffalo General Electric Company	1	105,555	0	0	869,317,170	204,209,960	665,107,210
19	Mohawk Hudson Power Corporation System	4	136,275	18	190,575	809,964,028	575,562,480	234,401,548
20	Brooklyn Edison Company	3	393,250	0	0	783,019,562	783,018,562	1,000
21	Pennsylvania Power and Light Company	7	(a) 150,650	2	450	707,995,258	587,193,790	120,801,468
22	Pennsylvania Water and Power Company	1	25,000	1	119,750	513,962,900	513,962,900	0
23	Metropolitan Edison System	.....	(a) 92,450	.....	15,100	366,726,210	361,687,140	5,039,070
24	Penn Public Service System	10	124,000	2	48,000	341,630,292	(b) 320,536,087	21,094,205
25	Rochester Gas and Electric Corporation	2	63,775	6	37,005	296,678,980	252,517,241	44,161,739
26	New York and Queens Electric Light and Power Company (*oo*)	1	5,000	0	0	209,748,985	1,736,720	208,012,265
27	Penn Central Light and Power Company	3	54,250	2	5,050	208,994,394	207,210,790	1,783,604
28	Scranton Electric Company	3	89,825	0	0	197,864,432	195,206,180	2,658,252
29	Syracuse Lighting Company	0	0	0	0	193,244,088	0	193,244,088
30	York Haven Water and Power Company	0	0	1	(a) 14,500	138,525,000	98,650,000	39,875,000
31	Metropolitan Power Company	1	(a) 30,000	0	0	122,851,000	122,851,000	0
32	Edison Electric Company, Lancaster	0	0	0	0	118,617,000	0	118,617,000
33	Westchester Lighting Company (*oo*)	1	(a) 9,070	0	0	104,207,062	26,340	104,180,722
	Totals for section	83	4,252,630	39	1,062,770	17,479,953,287	14,856,828,785	2,623,124,502
	South Atlantic States							
34	Southern Power Company	4	130,250	15	478,305	1,187,872,330	1,140,253,730	47,618,600
35	Consolidated Gas Electric Light and Power Co. of Baltimore	2	212,222	1	750	718,195,433	416,743,833	301,450,600
36	Georgia Railway and Power Company	2	21,500	9	186,000	435,441,973	275,864,812	159,577,161
37	Potomac Electric Power Company	.....	120,222	0	0	318,700,406	318,693,585	6,821
38	Virginia Electric and Power Company	5	(a) 92,215	9	(a) 27,550	304,400,743	292,259,898	12,140,845
39	Appalachian Power Company	1	60,000	2	29,000	292,000,000	285,300,000	7,000,000
40	Columbus Electric and Power Company	1	(a) 9,000	4	(a)(c) 23,540	204,811,841	136,684,576	68,127,265
41	Carolina Power and Light Company	5	(a) 37,010	9	(a) 7,455	160,646,601	110,644,805	50,001,796
42	Potomac Edison Company	5	54,165	4	6,350	158,537,000	157,779,500	757,500
43	Virginian Power Company					No Report Received		
44	Consolidated Power and Light Company	1	39,700	0	0	164,351,647	145,465,197	18,886,450
45	Yadkin River Power Company	1	(a) 1,500	1	(a) 24,000	144,950,100	74,398,300	70,511.800
	Totals for section	26	762,559	54	797,605	3,925,556,427	3,208,623,039	717,192,388
	East North Central States							
46	Commonwealth Edison Company	8	(a) 867,500	0	0	3,091,424,000	2,996,281,000	95,143,000
47	Detroit Edison Company	4	(a) 503,000	6	(a) 8,850	1,732,420,700	1,731,423,200	997,500
48	Cleveland Electric Illuminating Company	2	360,000	0	0	989,409,700	989,409,700	0
49	Ohio Power Company	11	203,545	1	1,500	890,509,813	340,848,590	549,661,223
50	Consumers Power Company	12	(a) 130,050	30	(a) 107,140	686,548,440	632,125,639	54,422,801
51	Public Service Company of Northern Illinois	15	(a) 181,875	3	(a) 4,840	(d) 615,092,925	(d) 539,265,296	75,827,629
52	Union Gas and Electric Company	2	147,910	0	0	562,408,247	494,668,747	67,739,500
53	Ohio Public Service Company	7	172,558	1	900	522,063,648	450,893,250	71,170,398
54	Pennsylvania-Ohio Power and Light Company	3	163,500	1	1,250	417,368,862	403,068,814	14,300,048

Supplement to ELECTRICAL WORLD, April 24, 1926

Rating, Output, Load Factor, Customers and Distrib
g an Output Over 100,000,000 Kw.-Hr. During 1925

1925	Distribution of Energy in Kilowatt-Hours, 1925								Customers,	
Purchased Kw.-Hr.	Residential	Commercial Lighting	Power	Light and Power	Electric Railways	Other Public Utilities	Intra-Company Business	Line Losses	Residental	Commercial Lighting
(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
239,675,068	0	0	276,842,952	276,842,952	43,100,064	275,798,666	(f)	(g) 85,954,364	0	0
19,719,858	65,801,794	(k)	(k) 353,530,615	419,332,409	7,121,375	73,715,990	2,586,021	(j) 145,322,563	189,956	(k)
28,143,300	0	0	91,977,355	91,977,355	28,949,670	160,367,552	11,552,438	24,925,265	0	0
19,333,938	16,236,089	17,165,674	137,124,610	170,526,373	17,752,883	50,196,536	418,746	(j) 48,270,680	51,034	9,080
14,447,000	32,437,000	12,161,000	108,152,000	152,750,000	0	0	939,900	22,504,000	81,351	459
45,045,000	15,931,000	26,283,000	61,140,000	103,354,000	6,333,000	63,230,000	523,000	16,915,000	43,200	11,800
1,290,677	(k) 21,922,230	(l)	(o) 88,273,721	110,195,951	(m) 11,911,336	17,219,993	(n)	35,616,297	(k) 54,981	(l)
0	(k) 14,120,848	(l)	105,018,927	119,139,775	1,017,216	18,693,184	1,349,115	15,271,349	(k) 32,905	(l)
76,498,459	6,983,219	(r) 10,277,020	92,166,902	109,427,141	0	10,713,905	400,000	18,334,547	(p) 38,276	(q)
9,674,200	13,165,643	14,015,215	50,942,273	78,123,131	0	13,944,575	4,805,039	11,949,555	43,408	6,548
453,827,500										
0	0	2,269,449	1,873,085,797	1,875,355,246	8,525,619	1,160,055,626	14,290,798	(s) 102,902,721		
81,800	(k) 1,307,004,068	(l)	(l)	1,307,004,068	227,799,082	359,803,939	(f)	(g) 368,013,320	(p) 543,695	(q)
0	107,057,718	217,954,509	555,107,279	880,119,506	(u) 368,339,843	93,729,329	7,412,997	172,038,304	322,215	75,570
96,499,785	(k) 294,728,830	(l)	614,786,483	909,515,313	208,940,093	7,401,140	7,110,697	225,350,929	(k) 595,232	(l)
2,325,447	(x) 103,191,004	(w) 170,995,451	(y) 504,475,092	778,661,547	239,789,632	37,942,900	(z) 55,707,387	117,760,663		
1,148,858	44,636,575	64,587,442	706,854,091	816,078,108	79,247,118	29,886,148	(f)	(g) 164,992,214	111,955	27,118
764,091,441	(k) 18,433,299	(l)	175,727,036	194,160,335	97,576,329	458,674,818	(f)	(g) 121,990,689	(k) 31,714	(l)
665,107,210	83,822,470	(A) 95,020,723	503,305,306	682,148,499	74,944,100	0	1,322,679	110,901,892	124,959	20,393
234,401,548	36,209,120	(B) 66,933,173	309,936,832	413,079,125	94,811,281	166,631,237	9,920,273	125,522,112	129,466	23,011
1,000	146,313,460	252,049,819	190,297,145	588,660,424	3,996,000	1,920,556	(C) 46,364,182	142,078,400	512,055	77,908
120,801,468	34,770,110	(D) 56,636,373	461,174,525	552,581,008	58,305,303	25,035,200		72,073,747	124,376	(E) 23,813
0						460,828,700		(F)		
5,039,070	10,156,000	15,916,000	156,606,000	182,678,000	26,602,000	52,142,000	(f)	(g) 105,304,210	(p) 50,455	(q)
21,094,205	(k) 42,101,612	(l)	212,649,280	254,750,892	16,666,576	7,173,756	(G) 4,286,483	58,752,585	(p) 86,303	(q)
44,161,739	(H) 47,585,088	(l)	136,833,643	184,418,731	42,087,299	7,943,912	10,931,425	51,297,613	(k) 75,530	(l)
208,012,265	43,335,055	(I) 41,076,079	88,961,191	173,372,323	2,843,190	0	2,256,667	31,276,805	(J) 169,831	(J) 19,645
1,783,604	12,968,105	11,225,994	118,111,948	142,306,047	5,694,487	21,811,187	10,287,343	28,895,330	34,545	5,116
2,658,252	14,172,775	16,964,732	100,027,904	131,165,411	24,931,786	0	17,405,131	24,362,104	52,157	9,585
193,244,088	(k) 26,813,299	(l)	133,265,265	160,078,564	2,814,146	10,445,965	2,842,558	17,062,855	(k) 45,854	
39,875,000	122,000	47,000	57,714,000	57,883,000	0	42,596,000	19,042,000	17,785,000	(p) 705	(q)
0	0	0	0	0	0	122,851,000	0	0	0	0
118,617,000	6,415,602	(K) 11,348,001	59,329,681	77,093,284	20,192,820	5,564,110	300,339	15,466,447	(p) 30,100	(q)
104,180,722	(L) 60,327,462	(l)	(l)	60,327,462	2,289,300	(M) 19,713,715	831,496	21,045,089	(p) 73,186	(q)
2,623,124,502										
47,618,600										
301,450,600	55,027,695	(N) 83,067,040	333,746,167	471,840,902	150,055,856	23,318,881	3,946,994	69,032,800	136,324	22,009
159,577,161	(k) 50,773,040	(l)	200,086,277	250,859,317	61,098,199	40,321,939	3,049,252	80,113,266	(p) 55,652	(q)
6,821	(k) 105,617,193	(l)	64,186,764	169,803,957	84,059,407	3,066,258	8,167,362	53,603,422	(p) 104,309	(q)
12,140,845	(O) 211,854,452	(l)	(l)		(l)	(l)	46,402,826	46,143,465	(p) 83,697	(q)
7,000,000	3,500,000	1,708,338	200,000,000	205,208,338	1,000,000	44,632,761	1,000,000	40,158,901	(p) 15,094	(q)
68,127,265	1,485,126	1,811,416	113,329,030	117,625,572	0	68,825,530	372,271	17,313,908	(p) 7,637	(q)
50,001,796	5,818,447	(P) 16,960,003	78,646,628	101,425,078	0	33,506,039	1,555,700	24,195,784	18,213	5,716
757,500	(k) 18,549,000	(l)	101,550,000	120,099,000	7,454,400	6,956,200	480,000	13,547,400	(k) 31,581	(l)
18,886,450	4,673,389	(PP) 8,132,675	38,163,853	50,969,917	5,719,577	95,017,891	3,466,698	9,177,564	12,538	3,323
70,511.800	3,740,816	(Q) 8,730,065	73,017,308	85,488,189	0	31,585,681	0	27,876,230	10,006	3,398
717,192,388										
95,143,000	323,219,000	(R) 312,004,000	(S) 1,128,528,000	1,763,751,000	831,188,000	170,700,000	12,123,000	313,662,000	679,497	112,208
997,500	174,359,654	190,103,661	850,214,892	1,214,678,207	169,468,320	57,020,284	15,127,100	(T) 276,126,800	362,799	59,159
0	106,070,467	(U) 69,921,651	469,954,669	645,946,787	121,601,709	80,265,100	74,272,625	67,323,479	213,685	(U) 28,859
549,661,223										
54,422,801	59,042,130	61,085,562	348,708,462	468,836,154	66,358,201	3,783,126	3,468,917	144,102,042	187,443	29,970
75,827,629	58,393,957	36,635,007	240,900,075	335,929,039	50,107,668	100,793,409	(V) 2,947,092	101,075,845	165,996	21,626
67,739,500	39,233,367	(W) 54,427,057	230,352,506	324,012,930	59,565,329	80,514,470	27,171,221	71,144,297	106,764	18,266
71,170,398	25,223,854	20,383,436	352,095,638	397,702,928	0	67,646,944	6,686,080	50,027,696	55,261	8,845
14,300,048	26,639,435	(X) 29,156,879	236,760,858	292,557,172	(Y) 32,878,305	28,428,734	(f)	(g) 45,307,791	56,557	(Z) 8,190

Supplement to ELECTRICAL WORLD, April 24, 1926

ed Data on Generator Rating, Output, Load Factor,
All Companies Having an Output Over 100,000,00

Generator Rating, Jan. 1, 1926				Generated and Purchased Output, 1925			Distribution of Energy in Kilowatt-Ho				
Fuel Burning Plants		Hydro Plants									
No. of Plants (3)	Rating of Generators, Kva. (4)	No. of Plants (5)	Rating of Generators, Kva. (6)	Total Output, Kw.-Hr. (7)	Generated, Kw.-Hr. (8)	Purchased Kw.-Hr. (9)	Residential (10)	Commercial Lighting (11)	Power (12)	Light and Power (13)	Electric Railways (14)
1	17,900	7	134,860	681,696,046	442,020,978	239,675,068	0	0	276,842,952	276,842,952	43,100,06
3	283,417	0	0	648,078,358	628,358,500	19,719,858	65,801,794	(k)	(k) 353,530,615	419,332,409	7,121,37
1	37,500	3	67,500	317,772,280	289,628,980	28,143,300	0	0	91,977,355	91,977,355	28,949,67
2	94,600	2	30,600	287,165,218	267,831,280	19,333,938	16,236,089	17,165,674	137,124,610	170,526,373	17,752,88
1	133,375	0	0	278,445,000	263,948,000	14,447,000	32,437,000	12,161,000	108,152,000	152,750,000	
.....	76,000	.....	2,000	190,355,000	145,310,000	45,045,000	15,931,000	26,283,000	61,140,000	103,354,000	6,333,00
2	16,875	22	49,035	174,943,577	173,652,900	1,290,677	(k) 21,922,230	(l)	(o) 88,273,721	110,195,951	(m) 11,911,33
1	115,000	0	0	155,470,639	155,470,639	0	(k) 14,120,848	(l)	105,018,927	119,139,775	1,017,21
2	(a) 36,650	3	(a) 1,750	138,876,293	62,377,834	76,498,459	6,983,219	(r) 10,277,020	92,166,902	109,427,141	
1	71,225	0	0	108,822,300	99,148,100	9,674,200	13,165,643	14,015,215	50,942,273	78,123,131	
14	889,092	37	286,055	2,981,624,711	2,527,747,211	453,827,500	.....	.....	.....	.....	.....
0	0	3	597,590	3,161,130,010	3,161,130,010	0	0	2,269,449	1,873,085,797	1,875,355,246	8,525,61
7	(a) 891,000	0	0	2,262,620,409	2,262,538,609	81,800	(k) 1,307,004,068	(l)	(l)	1,307,004,068	227,799,08
6	(a) 522,750	0	0	1,521,639,979	1,521,639,979	0	107,057,718	217,954,509	555,107,279	880,119,506	(u) 368,339,84
13	447,550	0	0	1,358,318,172	1,261,818,387	96,499,785	(k) 294,728,830	(l)	614,786,483	909,515,313	208,940,09
5	382,200	0	0	1,230,292,597	1,227,967,150	2,325,447	(x) 103,191,004	(w) 170,995,451	(y) 504,475,092	778,661,547	239,789,62
12	(a) 331,365	2	(a) 210	1,090,203,588	1,089,054,730	1,148,858	44,636,575	64,587,442	706,854,091	816,078,108	79,247,11
3	35,200	2	32,000	872,402,171	108,310,730	764,091,441	(k) 18,433,299	(l)	175,727,036	194,160,335	97,576,32
1	105,555	0	0	869,317,170	204,209,960	665,107,210	83,822,470	(A) 95,020,723	503,305,306	682,148,499	74,944,10
4	136,275	18	190,575	809,964,028	575,562,480	234,401,548	36,209,120	(B) 66,933,173	309,936,832	413,079,125	94,811,28
3	393,250	0	0	783,019,562	783,018,562	1,000	146,313,460	252,049,819	190,297,145	588,660,424	3,996,00
7	(a) 150,650	2	450	707,995,258	587,193,790	120,801,468	34,770,110	(D) 56,636,373	461,174,525	552,581,008	58,305,30
1	25,000	1	119,750	513,962,900	513,962,900	0	.....	.....	.....	.....	.....
.....	(a) 92,450	.....	15,100	366,726,210	361,687,140	5,039,070	10,156,000	15,916,000	156,606,000	182,678,000	26,602,00
10	124,000	2	48,000	341,630,292	(b) 320,536,087	21,094,205	(k) 42,101,612	(l)	212,649,280	254,750,892	16,666,57
2	63,775	6	37,005	296,678,980	252,517,241	44,161,739	(H) 47,585,088	(l)	136,833,643	184,418,731	42,087,29
1	5,000	0	0	209,748,985	1,736,720	208,012,265	43,335,055	(I) 41,076,079	88,961,191	173,372,323	2,843,19
3	54,250	2	5,050	208,994,394	207,210,790	1,783,604	12,968,105	11,225,994	118,111,948	142,306,047	5,694,48
3	89,825	0	0	197,864,432	195,206,180	2,658,252	14,172,775	16,964,732	100,027,904	131,165,411	24,931,78
0	0	0	0	193,244,088	0	193,244,088	(k) 26,813,299	(l)	133,265,265	160,078,564	2,814,14
0	0	1	(a) 14,500	138,525,000	98,650,000	39,875,000	122,000	47,000	57,714,000	57,883,000	
1	(a) 30,000	0	0	122,851,000	122,851,000	0	0	0	0	0	
0	0	0	0	118,617,000	0	118,617,000	6,415,602	(K) 11,348,001	59,329,681	77,093,284	20,192,82
1	(a) 9,070	0	0	104,207,062	26,340	104,180,722	(L) 60,327,462	(l)	(l)	60,327,462	2,289,30
83	4,252,630	39	1,062,770	17,479,953,287	14,856,828,785	2,623,124,502	.....	.....	.....	.....	.....
4	130,250	15	478,305	1,187,872,330	1,140,253,730	47,618,600	.....	.....	.....	.....	.....
2	212,222	1	750	718,195,433	416,743,833	301,450,600	55,027,695	(N) 83,067,040	333,746,167	471,840,902	150,055,85
2	21,500	9	186,000	435,441,973	275,864,812	159,577,161	(k) 50,773,040	(l)	200,086,277	250,859,317	61,098,19
.....	120,222	0	0	318,700,406	318,693,585	6,821	(k) 105,617,193	(l)	64,186,764	169,803,957	84,059,40
5	(a) 92,215	9	(a) 27,550	304,400,743	292,259,898	12,140,845	(O) 211,854,452	(l)	(l)	.....	(l)
1	60,000	2	29,000	292,000,000	285,300,000	7,000,000	3,500,000	1,708,338	200,000,000	205,208,338	1,000,00
1	(a) 9,000	4	(a)(c) 23,540	204,811,841	136,684,576	68,127,265	1,485,126	1,811,416	113,329,030	117,625,572	
5	(a) 37,010	9	(a) 7,455	160,646,601	110,644,805	50,001,796	5,818,447	(P) 16,960,003	78,646,628	101,425,078	
5	54,165	4	6,350	158,537,000	157,779,500	757,500	(k) 18,549,000	(l)	101,550,000	120,099,000	7,454,40
				No Report Received							
1	39,700	0	0	164,351,647	145,465,197	18,886,450	4,673,389	(PP) 8,132,675	38,163,853	50,969,917	5,719,51
1	(a) 1,500	1	(a) 24,000	144,950,100	74,398,300	70,511.800	3,740,816	(Q) 8,730,065	73,017,308	85,488,189	
26	762,559	54	797,605	3,925,556,427	3,208,623,039	717,192,388	.....	.....	.....	.....	.....
8	(a) 867,500	0	0	3,091,424,000	2,996,281,000	95,143,000	323,219,000	(R) 312,004,000	(S) 1,128,528,000	1,763,751,000	831,188,00
4	(a) 503,000	6	(a) 8,850	1,732,420,700	1,731,423,200	997,500	174,359,654	190,103,661	850,214,892	1,214,678,207	169,468,32
2	360,000	0	0	989,409,700	989,409,700	0	106,070,467	(U) 69,921,651	469,954,669	645,946,787	121,601,70
11	203,545	1	1,500	890,509,813	340,848,590	549,661,223	.....	.....	.....	.....	.....
12	(a) 130,050	30	(a) 107,140	686,548,440	632,125,639	54,422,801	59,042,130	61,085,562	348,708,462	468,836,154	66,358,20
15	(a) 181,875	3	(a) 4,840	(d) 615,092,925	(d) 539,265,296	75,827,629	58,393,957	36,635,007	240,900,075	335,929,039	50,107,66
2	147,910	0	0	562,408,247	494,668,747	67,739,500	39,233,367	(W) 54,427,057	230,352,506	324,012,930	59,565,33
7	172,558	1	900	522,063,648	450,893,250	71,170,398	25,223,854	20,383,436	352,095,638	397,702,928	

45	Tuckahoe River Power Company	1	(a) 4,500	1	(a) 2,500	11,930,100	78,328,500	70,511,800			
	Totals for section	26	762,559	54	797,605	3,925,556,427	3,208,623,039	717,192,388			

ctor, Customers and Distribution of Energy of 0,000 Kw.-Hr. During 1925

Kilowatt-Hours, 1925				Customers, Jan. 1, 1926					Consumption per Customer (Not Including Railways and Other Utilities), 1925	Load Factor, Per Cent		Line No.
Electric Railways (14)	Other Public Utilities (15)	Intra-Company Business (16)	Line Losses (17)	Residental (18)	Commercial Lighting (19)	Power (20)	Electric Railways (21)	Other Public Utilities (22)		1923 (gg)	1925 (gg)	(1)
43,100,064	275,798,666	(f)	(g) 85,954,364	0	0	95	7	43	2,920,000	(ee) 47.1	(ee) 44.1	1
7,121,375	73,715,990	2,586,021	(j) 145,322,563	189,956	(h)	(i) 52,349	4	11	1,730	(ff) 39.3	(ff) 36.6	2
28,949,670	160,367,552	11,552,438	24,925,265	0	0	.....	.....	.....	.....	41.6	57.2	3
17,752,883	50,196,536	418,746	(j) 48,270,680	51,034	9,080	1,885	.....	.....	2,740	41.9	(ee) 48.1	4
0	0	939,900	22,504,000	81,351	459	2,899	0	0	1,800	(ff) 48.5	34.6	5
6,333,000	63,230,000	523,000	16,915,000	43,200	11,800	2,200	1	9	1,810	35.4	41.8	6
11,911,336	17,219,993	(n)	35,616,297	(k) 54,981	(l)	3,646	.....	.....	1,880	(ff) 51.8	.....	7
1,017,216	18,693,184	1,349,115	15,271,349	(k) 32,905	(l)	1,370	1	1	3,480	33.5	36.8	8
0	10,713,905	400,000	18,334,547	(p) 38,276	(q)	(q)	(q)	(q)	2,860	33.2	34.0	9
0	13,944,575	4,805,039	11,949,555	43,408	6,548	1,367	0	4	1,520	.....	39.8	10
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
8,525,619	1,160,055,626	14,290,798	(s) 102,902,721	.....	.....	.....	.....	.....	.....	(ff) 83.0	82.7	11
227,799,082	359,803,939	(f)	(g) 368,013,320	(p) 543,695	(q)	(q)	(q)	(q)	2,400	40.5	40.2	12
368,339,843	93,729,329	7,412,997	172,038,304	322,215	75,570	14,310	6	3	2,140	45.3	48.1	13
208,940,093	7,401,140	7,110,697	225,350,929	(k) 595,232	(l)	20,769	8	4	1,480	44.2	44.0	14
239,789,632	37,942,900	(z) 55,707,387	117,760,663	.....	.....	.....	.....	.....	.....	(ff) 55.2	52.8	15
79,247,118	29,886,148	(f)	(g) 164,992,214	111,955	27,118	4,679	47	18	5,670	59.7	59.4	16
97,576,329	458,674,818	(f)	(g) 121,990,689	(k) 31,714	(l)	1,031	18	54	5,930	56.8	57.9	17
74,944,100	0	1,322,679	110,901,892	124,959	20,393	3,632	1	10	4,580	53.0	52.5	18
94,811,281	166,631,237	9,920,273	125,522,112	129,466	23,011	6,281	6	13	2,600	.....	54.0	19
3,996,000	1,920,556	(C) 46,364,182	142,078,400	512,055	77,908	11,289	3	2	982	39.3	40.0	20
58,305,303	25,035,200	.....	72,073,747	124,376	(E) 23,813	4,073	40	19	3,640	(ff) 59.2	62.0	21
.....	460,828,700	.....	(F)	.....	.....	.....	.....	5	.....	56.8	53.3	22
26,602,000	52,142,000	(f)	(g) 105,304,210	(p) 50,455	(q)	(q)	(q)	(q)	3,620	47.0	49.8	23
16,666,576	7,173,756	(G) 4,286,483	58,752,585	(p) 86,303	(q)	(q)	(q)	(q)	2,950	43.3	50.7	24
42,087,299	7,943,912	10,931,425	51,297,613	(k) 75,530	(l)	6,074	1	4	2,260	50.5	54.0	25
2,843,190	0	2,256,667	31,276,805	(f) 169,831	(f) 19,645	3,125	1	.....	900	40.4	40.3	26
5,694,487	21,811,187	10,287,343	28,895,330	34,545	5,116	1,369	58	14	3,480	47.1	51.7	27
24,931,786	0	17,405,131	24,362,104	52,157	9,585	2,383	1	0	2,050	.....	52.8	28
2,814,146	10,445,965	2,842,558	17,062,855	(k) 45,854	.....	5,611	.....	.....	3,120	48.9	53.7	29
0	42,596,000	19,042,000	17,785,000	(p) 705	(q)	(q)	(q)	(q)	82,100	.....	93.0	30
0	122,851,000	0	0	0	0	0	0	1	.....	.....	38.9	31
20,192,820	5,564,110	300,339	15,466,447	(p) 30,100	(q)	(q)	(q)	(q)	2,560	46.4	41.7	32
2,289,300	(M) 19,713,715	831,496	21,045,089	(p) 73,186	(q)	(q)	(q)	(q)	825	.....	42.3	33
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(ee) 42.2	(ee) 45.6	34
150,055,856	23,318,881	3,946,994	69,032,800	136,324	22,009	272	1	2	2,980	(ee) 55.9	(ee) 51.0	35
61,098,199	40,321,939	3,049,252	80,113,266	(p) 55,652	(q)	(q)	(q)	(q)	6,300	48.2	45.6	36
84,059,407	3,066,258	8,167,362	53,603,422	(p) 104,309	(q)	(q)	(q)	(q)	1,626	45.2	44.9	37
(l)	(l)	46,402,826	46,143,465	(p) 83,697	(q)	(q)	(q)	(q)	.....	48.3	43.8	38
1,000,000	44,632,761	1,000,000	40,158,901	(p) 15,094	(q)	(q)	(q)	(q)	13,600	(ee) 58.4	(ee) 53.0	39
0	68,825,530	372,271	17,313,908	(p) 7,637	(q)	(q)	(q)	(q)	15,400	49.8	47.4	40
0	33,506,039	1,555,700	24,195,784	18,213	5,716	1,096	0	4	4,050	.....	(ff) 39.8	41
7,454,400	6,956,200	480,000	13,547,400	(k) 31,581	(l)	1,758	3	18	3,600	(ff) 50.5	51.7	42
												43
5,719,577	95,017,891	3,466,698	9,177,564	12,538	3,323	520	1	4	3,120	.....	(ff) 54.8	44
0	31,585,681	0	27,876,230	10,006	3,398	526	0	6	6,140	(ff) 38.9	(ff) 36.8	45
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
831,188,000	170,700,000	12,123,000	313,662,000	679,497	112,208	19,655	3	3	2,180	47.1	44.5	46
169,468,320	57,020,284	15,127,100	(T) 276,126,800	362,799	59,159	11,772	32	4	2,800	51.2	50.8	47
121,601,709	80,265,100	74,272,625	67,323,479	213,685	(U) 28,859	2,069	1	6	2,640	49.6	45.7	48
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	56.0	49
66,358,201	3,783,126	3,468,917	144,102,042	187,443	29,970	7,604	.....	.....	2,090	47.9	50.2	50
50,107,668	100,793,409	(V) 2,947,092	101,075,845	165,996	21,626	10,007	7	5	1,700	50.4	42.4	51
59,565,329	80,514,470	27,171,221	71,144,297	106,764	18,266	4,528	5	6	3,260	46.8	44.2	52
0	67,646,944	5,686,080	50,027,696	55,261	8,845	1,834	0	20	6,030	(ff) 51.3	(ff) 56.1	53
32,333,350	21,210,000	6,730,000	13,017,508	65,155,150	.....	0	31,565,001	0	2,670,250	10,000	3,570	
70,511,800	3,140,000	0	0	0	0	0	0	0	0	0	0	
717,192,388	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	

45	Tallulah River Power Company	1	(a)	1,500	1	(a)	24,000	144,950,100	74,398,300	70,511,800
	Totals for section	26		762,559	54		797,605	3,925,556,427	3,208,623,039	717,192,388
	East North Central States									
46	Commonwealth Edison Company	8	(a)	867,500	0		0	3,091,424,000	2,996,281,000	95,143,000
47	Detroit Edison Company	4	(a)	503,000	6	(a)	8,850	1,732,420,700	1,731,423,200	997,500
48	Cleveland Electric Illuminating Company	2		360,000	0		0	989,409,700	989,409,700	0
49	Ohio Power Company	11		203,545	1		1,500	890,509,813	340,848,590	549,661,223
50	Consumers Power Company	12	(a)	130,050	30	(a)	107,140	686,548,440	632,125,639	54,422,801
51	Public Service Company of Northern Illinois	15	(a)	181,875	3	(a)	4,840	(d) 615,092,925	(d) 539,265,296	75,827,629
52	Union Gas and Electric Company	2		147,910	0		0	562,408,247	494,668,747	67,739,500
53	Ohio Public Service Company	7		172,558	1		900	522,063,648	450,893,250	71,170,398
54	Pennsylvania-Ohio Power and Light Company	3		163,500	1		1,250	417,368,862	403,068,814	14,300,048
55	Toledo Edison Company	3		142,610	1		8,340	350,518,281	341,198,888	9,319,393
56	Northern Ohio Traction and Light Company	1		67,000	1		2,200	304,116,460	167,333,800	136,782,660
57	Dayton Power and Light Company	5		125,280	0		0	275,502,706	275,098,306	404,400
58	Central Indiana Power Company System	12		142,880	1		480	262,971,086	260,642,648	2,328,438
59	Michigan Northern Power Company	0		0	.....	(e)	45,600	252,186,398	252,186,398	0
60	Central Illinois Public Service Company	18		92,815	0		0	247,311,779	158,354,848	88,956,931
61	Indianapolis Light and Power Company	2		100,000	0		0	196,762,929	196,762,929	0
62	Indiana and Michigan Electric Company	2		114,210	4		25,175	180,932,804	180,892,804	40,000
63	Northern Indiana Gas and Electric Company	3	(a)	43,350	0		0	170,852,661	118,034,676	52,817,985
64	Cleveland Munic. Electric Light System	1		62,500	0		0	151,475,140	151,475,140	0
65	United Light and Power Company							No Report Received		
66	Moline-Rock Island Manufacturing Company	2		71,500	2		5,100	108,316,069	78,503,700	29,812,369
67	Central Illinois Light Company	2	(a)	33,000	0		0	106,992,465	47,918,565	59,073,900
	Totals for section	115		4,036,308	51		353,585	12,115,185,113	10,806,386,938	1,308,798,175
	West North Central States									
68	North American Company (Missouri, Illinois and Iowa)	.....	(a)	281,850	.....	(a)	101,200	1,200,506,087	1,199,094,153	1,411,934
69	North American Company (Wisconsin System)	.....	(a)	245,830	.....	(a)	31,000	849,064,272	784,298,637	64,765,635
70	Northern States Power Company	25	(ii)	300,354	27	(ii)	147,208	742,601,203	(jj) 685,347,077	57,254,126
71	Minnesota Power and Light Company	7	(a)	14,450	11	(a)	94,864	364,574,445	361,175,455	3,398,990
72	Kansas City Power and Light Company	4		174,946	0		0	339,117,030	338,838,100	278,930
73	North West Utilities Company	.....		33,535	.....		50,785	336,956,523	248,992,758	87,963,765
74	Empire District Electric Company	1		75,625	3		16,000	178,047,098	160,148,410	17,898,688
75	Kansas Gas and Electric Company	7	(a)	50,190	1		550	177,590,200	177,518,200	72,000
76	Nebraska Power Company	1	(a)	73,000	0		0	177,233,500	177,233,500	0
77	Wisconsin Public Service Corporation	3	(ii)	28,073	9	(ii)	39,018	128,835,193	122,805,155	6,030,038
	Totals for section	48		1,357,106	51		512,335	4,494,525,551	4,255,451,445	239,074,106
	East South Central States									
78	Southeastern Power and Light Company	22	(kk)	144,845	7	(kk)	160,225	1,196,244,494	1,137,299,342	58,945,152
79	Tennessee Electric Power Company	.....		113,350	.....		131,030	654,488,668	648,899,318	5,589,350
80	New Orleans Public Service Inc.	3	(a)	90,200	0		0	252,735,540	252,735,540	0
81	Birmingham Electric Company	1		11,700	0		0	224,109,866	0	224,109,866
82	Louisville Gas and Electric Company	1	(ii)	125,317	0		0	217,377,479	(jj) 200,250,819	17,126,660
83	Memphis Power and Light Company	1	(a)	54,000	0		0	121,627,000	121,627,000	
	Totals for section	28		549,000	7		291,255	2,666,583,047	2,360,812,019	305,771,026
	West South Central States									
84	Texas Power and Light Company	19		26,073	0		0	264,399,000	80,902,000	183,497,000
85	Houston Lighting and Power Company	1	(a)	73,076	0		0	199,847,650	199,427,310	420,340
86	Fort Worth Power and Light Company	1	(a)	44,000	0		0	183,622,525	183,595,700	26,825
87	Oklahoma Gas and Electric Company	13		63,886	0		0	156,979,298	144,517,010	12,462,288
88	Oil Belt Power Company	1	(a)	18,000	0		0	147,218,200	147,218,200	0
89	Dallas Power and Light Company	1	(a)	35,500	0		0	144,739,433	136,323,617	8,415,816
	Totals for section	36		461,535	0		0	1,096,806,106	.....	.....
	Mountain States									
90	Montana Power Company	0		0	(ll)	8	227,000	1,234,052,127	1,234,052,127	0
91	Utah Power and Light Company	3	(a)	37,040	35	(a)	159,797	744,186,000	658,479,000	85,707,000
92	Public Service Company of Colorado	8		65,952	5		33,700	244,055,341	239,457,918	4,597,423
93	Idaho Power Company	0		0	8	(a)	59,500	198,959,000	193,901,000	5,058,000
	Totals for section	11		109,652	56		737,997	2,421,252,468	2,325,890,045	95,362,423
	Pacific States									
94	Pacific Gas and Electric Company	4	(a)	142,000	28	(a)	398,975	2,001,474,640	1,623,906,794	377,567,846
95	Southern California Edison Company	.....		214,400	.....		348,350	1,987,661,654	1,980,386,638	7,275,016
96	Great Western Power Company	4		30,000	2		131,000	633,357,021	631,196,680	2,160,341
97	Puget Sound Power and Light Company	8	(a)	33,350	13	(a)	138,145	632,626,358	518,463,539	114,162,819
98	San Joaquin Light and Power Corporation	3		54,050	11		84,600	554,614,141	481,115,636	73,498,505
99	Washington Water Power Company	0		0	7		139,750	515,523,750	490,523,000	25,000,750
100	Los Angeles Bureau Light and Power	0		0	5		110,420	479,878,822	(jj) 182,290,040	297,588,782
101	Portland Electric Power Company	3	(a)	36,500	6	(a)	78,730	421,155,600	420,782,200	373,400
102	Southern Sierras Power Company (mm)	5		13,418	11		66,495	260,300,140	233,412,530	26,887,610
103	California Oregon Power Company	.....		350	.....	(rr)	70,210	(ss) 251,310,788	(tt) 250,653,208	(uu) 443,028
104	Seattle Municipal Light and Power System	.....		35,000	.....		65,000	218,245,950	218,245,950	0
105	Northeastern Electric Company	2		22,500	1		12,000	196,911,791	152,212,481	44,699,310
106	Los Angeles Gas and Electric Corporation	2	(a)	108,700	0		0	184,683,171	184,566,264	116,907
107	Tacoma Light Department	1		11,250	1		24,000	157,662,360	144,080,485	13,581,875
108	Pacific Power and Light Company	6	(a)	13,175	10	(a)	22,375	155,585,707	110,062,603	45,523,104
109	Western States Gas and Electric Company	2	(ii)	11,390	3	(ii)	35,470	128,571,450	110,654,910	17,916,540
110	San Diego Consolidated Gas and Electric Company	2	(ii)	41,540	0		0	117,956,180	109,757,430	8,198,750
	Totals for section	42		819,728	98		1,834,125	8,897,519,523	7,842,310,388	1,055,004,577
	Canada									
111	Hydro-Electric Power Commission of Ontario (vv)	1		15,000	21		787,854	3,298,347,874	3,116,618,428	181,729,446
112	Shawinigan Water and Power Company	0		0	15		391,000	2,421,046,311	1,887,949,211	533,097,100
113	Montreal Light, Heat and Power Consolidated	1		20,250	4		225,410	1,175,430,654	824,135,729	351,294,925
114	British Columbia Electric Railway, Ltd.	1		12,500	3		113,325	336,907,650	6,265,400	330,642,250
115	City of Winnipeg Hydro-Electric System	1		13,750	1		76,500	261,996,380	256,372,080	5,624,300
116	Winnipeg Electric Company	1	(a)	12,000	2		67,000	252,891,600	(ww) 252,891,600	0
117	Kaministiquia Power Company, Ltd.	0		0	1		26,500	107,576,036	101,226,000	6,350,000
	Electric Railways									
	Interborough Rapid Transit Company			390,000	0		0	1,063,791,454	1,063,504,660	286,794

717,192,388																			
95,143,000		323,219,000	(R)	312,004,000	(S)	1,128,528,000	1,763,751,000		831,188,000	170,700,000		12,123,000		313,662,000		679,497	112,208
997,500		174,359,654		190,103,661		850,214,892	1,214,678,207		169,468,320	57,020,284		15,127,100	(T)	276,126,800		362,799	59,159
0		106,070,467	(U)	69,921,651		469,954,669	645,946,787		121,601,709	80,265,100		74,272,625		67,323,479		213,685	(U) 28,859
549,661,223																			
54,422,801		59,042,130		61,085,562		348,708,462	468,836,154		66,358,201	3,783,126		3,468,917		144,102,042		187,443	29,970
75,827,629		58,393,957		36,635,007		240,900,075	335,929,039		50,107,668	100,793,409	(V)	2,947,092		101,075,845		165,996	21,626
67,739,500		39,233,367	(W)	54,427,057		230,352,506	324,012,930		59,565,329	80,514,470		27,171,221		71,144,297		106,764	18,266
71,170,398		25,223,854		20,383,436		352,095,638	397,702,928		0	67,646,944		6,686,080		50,027,696		55,261	8,845
14,300,048		26,639,435	(X)	29,156,879		236,760,858	292,557,172	(Y)	32,878,305	28,428,734		(f)	(g)	45,307,791		56,557	(Z) 8,190
9,319,393		30,672,610		33,827,195		152,744,313	217,244,118		27,926,692	9,235,766	(aa)	42,363,332		53,748,373		70,193	9,140
136,782,660		25,435,269		18,777,553		155,162,536	199,375,358	(Y)	51,282,520	4,156,386		1,765,957		47,536,239		47,847	6,750
404,400		19,178,903	(bb)	23,634,842		92,322,020	135,135,765		40,219,648	66,791,884		1,221,037		31,494,862		60,976	8,211
2,328,438		17,959,193		33,042,521		87,781,737	138,783,451		3,815,740	49,186,595		15,650,244		47,926,000			
0		0		1,384		249,346,968	249,348,352		644,900	1,726,380		336,266		130,500			
88,956,931		20,807,614		24,473,443		115,519,034	160,800,091		0	8,995,247		33,391,673		44,124,768	(k)	115,168	(l)
0		21,771,761		(k)	(i)	112,423,909	134,195,670		0	15,267,838		7,967,294		39,332,127	(p)	74,041	(q)
40,000		11,158,338		11,172,617		56,501,223	78,832,178		11,969,120	58,329,019	(cc)	4,811,696		26,990,791		34,581	3,492
52,817,985	(k)	29,287,099		(l)		97,057,776	126,344,875		14,762,431	5,518,199		1,014,111		23,213,045	(dd)	42,018	(l)
0	(k)	31,046,898		(l)		71,808,984	102,855,882		0	18,644,178		11,995,140		17,979,940	(p)	40,078	(q)
29,812,369		0		0		0	0		22,156,819	85,043,937						0	0
59,073,900		8,935,037		10,029,060		69,702,310	88,666,407		262,937	7,118,708		127,920		10,816,493		28,788	5,302
1,308,798,175																			
1,411,934															(p)	256,168	(q)
64,765,635															(p)	211,836	(q)
57,254,126		80,734,981	(yy)	155,036,552		284,990,469	520,762,002		3,035,771	43,808,743		13,690,899		161,303,788		241,305	42,736
3,398,990		13,966,663	(zz)	37,599,195		190,447,825	242,013,683		17,666,933	34,674,784				69,582,449		36,872	7,483
278,930		41,055,468		46,519,835		183,757,700	271,333,003	(AA)	18,794,686	(n)		1,734,055		47,255,286		91,991	18,470
87,963,765	(k)	27,259,492		(l)	(BB)	83,009,340	110,268,832		(k)	164,642,948				39,003,573	(k)	72,417	(l)
17,898,688		5,967,268		5,803,605		121,850,742	133,621,615		0	13,362,462		1,105,122		29,957,899		15,222	1,550
72,000		15,256,802	(DD)	23,342,896		96,314,958	134,914,651		8,433,099	3,747,300				30,495,080		41,201	7,853
0		19,604,728	(EE)	32,427,795		81,511,920	133,544,443		22,302,299	1,378,300		111,410		19,897,048		46,602	7,088
6,030,038		7,277,520	(FF)	10,483,226		73,987,062	91,747,808		2,103,620	4,504,853		5,740,223		24,738,689		25,720	4,088
239,074,106																			
58,945,152		21,321,481		26,250,611		539,912,088	587,484,180		0	378,543,271		38,119,626		192,097,417		65,818	16,931
5,589,350	(k)	42,788,580		(l)		358,218,363	401,006,943		40,958,854	137,789,366				74,733,505	(GG)	32,042	6,319
0		16,235,561	(LL)	26,397,710		68,414,781	111,048,052		41,424,472	0		47,861,000		52,402,016		53,901	8,340
224,109,866		11,828,759		19,073,465		112,439,715	143,341,939		0	(HH) 1,113,114		46,533,203		29,646,929		38,882	7,430
17,126,660	(II)	52,290,598		(l)		89,952,951	142,243,549		0	42,824,400		1,898,752		24,022,234	(k)	69,695	(l)
0		10,490,936	(JJ)	35,178,878		27,995,347	73,665,161		27,749,754	519,400				19,732,685		31,604	6,886
305,771,028																			
183,497,000		15,920,936	(KK)	27,926,082		115,081,468	158,928,486		23,236,853	31,607,939		12,494,722		38,131,000		50,584	12,350
420,340		15,290,963	(MM)	25,471,329		122,328,971	163,091,263		3,296,830	274,366				33,185,191		44,494	8,511
26,825		10,323,569	(NN)	12,694,779		58,331,132	81,349,480		0	88,131,481				14,141,564		26,512	2,383
12,462,288		18,824,840	(OO)	23,301,138		62,313,824	104,439,802		2,865,531	16,954,234		2,375,865		30,343,868		55,070	10,627
0		152,502		152,774		30,249,168	30,554,444		0	102,769,062				14,045,877		15	41
8,415,816		16,561,509	(QQ)	25,348,218		46,981,951	88,891,678		42,177,248	0				13,670,507		45,513	6,366
0		16,548,715	(RR)	20,556,060		845,251,016	882,355,791	(SS)	128,028,433	27,158,809		(f)	(g)	196,509,094		35,747	8,267
85,707,000		30,045,109	(UU)	38,797,877		508,654,430	577,497,416		53,112,634	685,828				112,930,122		77,510	10,828
4,597,423		34,980,375		44,758,182		97,934,583	177,673,140		0	10,383,519		7,215,373		48,783,309		83,957	13,077
5,058,000		45,655,688	(VV)	16,952,132		81,064,703	143,672,523		4,858,950	3,628,292				46,799,235		32,907	5,091
95,362,423																			
377,567,846	(Aa)	245,944,756		(l)		719,787,839	965,732,595		260,156,904	(Bb) 130,225,407		51,156,669		594,203,065	(Cc)	378,225	(l)
7,275,016		71,668,826		71,240,570		1,080,421,674	1,223,331,070		247,053,231	36,169,648		1,706,630		429,401,075			
2,160,341		8,876,019		63,948,256		307,300,399	380,124,674		26,010,037	34,991,621	(Gg)	6,273,462	(Hh)	190,273,695		31,498	13,862
114,162,819															(p)	103,685	(q)
73,498,505		21,407,349		28,535,781		305,826,842	355,769,972		4,842,345	78,320,050		4,424,397		111,257,377		45,316	8,465
25,000,750	(t)	280,982,383		(l)		(l)	280,982,383		62,321,157	90,559,559		(f)	(g)	81,660,651	(t)	46,945	(l)
297,588,782	(Dd)	164,243,926		(l)	(Ee)	230,472,025	394,715,951		0	114,742	(Ff)	2,541,197			(k)	207,071	(l)
373,400		39,490,832		33,693,108		148,270,907	221,454,847		24,490,748	15,708,740		63,204,548		96,296,717		72,252	7,866
26,887,610		3,133,566		5,516,149		164,399,819	173,049,534		0	13,715,716				73,534,890		12,546	3,432
) 443,020		67,402,025		7,847,659		44,396,831	119,646,515		0	(Ii) 130,039,116				53,869,647		2,835	2,943
0															(p)	83,000	(q)
44,699,310		10,732,935	(Jj)	16,374,349		133,332,139	160,439,423		0	851,515				35,895,755		16,079	4,168
116,907		38,265,656		57,613,435		53,416,997	149,296,088		0	0		7,202,397		28,184,686		100,011	17,649
13,581,875	(k)	42,891,260		(l)		74,293,528	117,184,788		736,861	181,000		3,451,074		9,282,571		29,210	3,629
45,523,104		14,599,261	(Kk)	13,752,339		49,507,679	77,859,279		3,230,700	39,699,450				34,796,278		32,206	6,854
17,916,540	(Ll)	20,884,925		(l)		62,117,463	83,002,388		7,261,434	9,142,680		2,510,328		26,654,620	(k)	32,802	(l)
8,198,750	(Mm)	32,766,742		(l)		31,505,850	64,272,592		16,865,674	13,690,981		5,960,050		17,166,883	(k)	49,892	(l)
1,055,004,575																			
181,729,446																			
533,097,100		0		0		1,756,053,823	1,756,053,823		0	445,969,443		(f)	(g)	219,023,045					
351,294,925																			
330,642,250																			
5,624,300		78,273,217		78,596,900		36,107,753	192,977,870		0	3,637,348		0		65,381,162		54,983	6,151
0	(t)	167,813,061		(l)		(l)	167,813,061		46,083,339	5,628,600				33,357,600	(Nn)	82,964	3,623
6,350,000	(Oo)	24,016,565		(l)		68,804,285	92,820,850		(l)	(l)		757,820		13,997,366			
286,794		0		0		789,724	789,724		186,415,567	0	(Pp)	849,042,712		27,543,451			

0		31,585,681		0		27,876,230	10,006		3,398	526		0		6		6,140	(ff)	38.9	(ff) 36.8	44	
																			45	

Electric Railways

| | | |

286,794	0	0	789,724	789,724	186,415,567	0	(*Pp*) 849,042,712	27,543,451					
								11,500,000					
0	31,585,681	0	27,876,230	10,006	3,398	526	0	6	6,140	(*ff*) 38.9	(*ff*) 36.8	45	
831,188,000	170,700,000	12,123,000	313,662,000	679,497	112,208	19,655	3	3	2,180	47.1	44.5	46	
169,468,320	57,020,284	15,127,100	(*T*) 276,126,800	362,799	59,159	11,772	32	4	2,800	51.2	50.8	47	
121,601,709	80,265,100	74,272,625	67,323,479	213,685	(*U*) 28,859	2,069	1	6	2,640	49.6	45.7	48	
											56.0	49	
66,358,201	3,783,126	3,468,917	144,102,042	187,443	29,970	7,604			2,090	47.9	50.2	50	
50,107,668	100,793,409	(*V*) 2,947,092	101,075,845	165,996	21,626	10,007	7	5	1,700	50.4	42.4	51	
59,565,329	80,514,470	27,171,221	71,144,297	106,764	18,266	4,528	5	6	3,260	46.8	44.2	52	
0	67,646,944	6,686,080	50,027,696	55,261	8,845	1,834	0	20	6,030	(*ff*) 51.3	(*ff*) 56.1	53	
32,878,305	28,428,734	(*f*)	(*g*) 45,307,791	56,557	(*Z*) 8,190	1,380		3	4,430	63.7	50.7	54	
27,926,692	9,235,766	(*aa*) 42,363,332	53,748,373	70,193	9,140	2,179	2	19	2,660	42.8	53.7	55	
51,282,520	4,156,386	1,765,957	47,536,239	47,847	6,750	1,403			3,560	63.8	80.1	56	
40,219,648	66,791,884	1,221,037	31,494,862	60,976	8,211	2,161	9	5	1,895	38.4	45.0	57	
3,815,740	49,186,595	15,650,244	47,926,000								46.3	58	
644,900	1,726,380	336,266	130,500							86.5	87.0	59	
0	8,995,247	33,391,673	44,124,768	(*k*) 115,168	(*l*)	9,763	0	29	1,290	47.1	46.0	60	
0	15,267,838	7,967,294	39,332,127	(*p*) 74,041	(*q*)	(*q*)	(*q*)	(*q*)	1,812	49.0	(*ff*) 46.5	61	
11,969,120	58,329,019	(*cc*) 4,811,696	26,990,791	34,581	3,492	1,122	2	10	2,020	43.0	34.4	62	
14,762,431	5,518,199	1,014,111	23,213,045	(*dd*) 42,018	(*l*)	(*l*)	2	4	3,000		63.9	63	
0	18,644,178	11,995,140	17,979,940	(*p*) 40,078	(*q*)	(*q*)	(*q*)	(*q*)	2,570	56.2	55.8	64	
												65	
22,156,819	85,043,937			0	0	0	3	3			44.1	66	
262,937	7,118,708	127,920	10,816,493	28,788	5,302	1,320			2,500		(*Qq*) 49.0	67	
				(*p*) 256,168	(*q*)	(*q*)	(*q*)	(*q*)		(*ff*) 52.1	(*ff*) 52.9	68	
				(*p*) 211,836	(*q*)	(*q*)	(*q*)	(*q*)		45.8	(*ff*) 47.5	69	
3,035,771	43,808,743	13,690,899	161,303,788	241,305	42,736	14,155	5	104	1,744	50.0	52.9	70	
17,666,933	34,674,784		69,582,449	36,872	7,483	1,589	2	4	5,270	(*ff*) 56.9	(*ff*) 55.2	71	
18,794,686	(*n*)	1,734,055	47,255,286	91,991	18,470	4,130	3	12	2,370	(*Qq*) 52.7	(*Qq*) 54.5	72	
(*h*)	164,642,948		39,003,573	(*k*) 72,417	(*l*)	(*CC*) 4,854	(*h*)	(*h*)		53.7	50.3	73	
0	13,362,462	1,105,122	29,957,899	15,222	1,550	900	0	4	7,550	(*ff*) 29.6	(*ff*) 34.3	74	
8,433,099	3,747,300		30,495,080	41,201	7,853	1,884	5	1	2,650	(*ff*) 55.5	(*ff*) 56.6	75	
22,302,299	1,378,300	111,410	19,897,048	46,602	7,088	1,545	2	1	2,420	(*ff*) 53.8	(*ff*) 66.3	76	
2,103,620	4,504,853	5,740,223	24,738,689	25,720	4,088	1,482	1	11	2,940		50.7	77	
0	378,543,271	38,119,626	192,097,417	65,818	16,931	4,045	0	14	6,770	(*Rr*) 54.5	48.1	78	
40,958,854	137,789,366		74,733,505	(*GG*) 32,042	6,319	1,517			10,050	53.9	52.4	79	
41,424,472	0	47,861,000	52,402,016	53,901	8,340	1,851	3	0	1,734	(*ff*) 46.8	(*ff*) 44.4	80	
0	(*H H*) 1,113,114	46,533,203	29,646,929	38,882	7,430	1,759	0	47	2,980	(*ff*) 52.7	(*ff*) 71.3	81	
0	42,824,400	1,898,752	24,022,234	(*k*) 69,695	(*l*)	2,848	0	2	1,960	43.7	46.9	82	
27,749,754	519,400		19,732,685	31,604	6,886	1,478	5	1	1,840		40.4	83	
23,236,853	31,607,939	12,494,722	38,131,000	50,584	12,350	2,434	5	20	2,430	(*ff*) 68.6	(*ff*) 52.2	84	
3,296,830	274,366		33,185,191	44,494	8,511	3,290	1	3	2,890	(*ff*) 53.8	(*ff*) 58.0	85	
0	88,131,481		14,141,564	26,512	2,383	683	0	1	2,750	(*ff*) 61.0	(*ff*) 40.7	86	
2,865,531	16,954,234	2,375,865	30,343,868	55,070	10,627	3,660	5	29	1,505	(*ff*) 40.1	44.8	87	
0	102,769,062		14,045,877	15	41	53	0	4	280,000		72.0	88	
42,177,248	0		13,670,507	45,513	6,366	1,649	1	0	1,660	(*ff*) 73.8	(*ff*) 45.3	89	
128,028,433	27,158,809	(*f*)	(*g*) 196,509,094	35,747	8,267	2,077	(*TT*) 5	13	19,150	81.8	83.5	90	
53,112,634	685,828		112,930,122	77,510	10,828	3,015	6	5	6,330	67.3	75.6	91	
0	10,383,519	7,215,373	48,783,309	83,957	13,077	5,447	0	14	1,735		48.1	92	
4,858,950	3,628,292		46,799,235	32,907	5,091	2,007	2	5	3,590	(*ff*) 63.5	(*ff*) 59.0	93	
260,156,904	(*Bb*) 130,225,407	51,156,669	594,203,065	(*Cc*) 378,225	(*l*)	27,518	11	24	2,380	64.1	60.2	94	
297,053,231	36,169,648	1,706,630	429,401,075							(*ff*) 56.5	(*ff*) 57.3	95	
26,010,037	34,991,621	(*Gg*) 6,273,462	(*Hh*) 190,273,695	31,498	13,862	11,647	11	42	6,670	67.4	58.8	96	
				(*p*) 103,685	(*q*)	(*q*)	(*q*)	(*q*)		53.1	55.6	97	
4,842,345	78,320,050	4,424,397	111,257,377	45,316	8,465	10,732	2	4	5,510	72.5	57.0	98	
62,321,157	90,559,559	(*f*)	(*g*) 81,660,651	(*t*) 46,945	(*l*)	(*l*)	4	21	5,990	55.6	55.0	99	
0	114,742	(*Ff*) 2,541,197		(*k*) 207,071	(*l*)	9,209	0		1,825	49.7	50.2	100	
24,490,748	15,708,740	63,204,548	96,296,717	72,252	7,866	2,403	9	6	2,680	51.1	(*ee*) 45.6	101	
0	13,715,716		73,534,890	12,546	3,432	2,035	0	7	9,600	(*ff*) 62.6	(*ff*) 59.4	102	
0	(*Ii*) 130,039,116		53,869,647	2,835	2,943	703	0	9	7,250	54.0	42.7	103	
				(*p*) 83,000	(*q*)	(*q*)	(*q*)	(*q*)		38.2	44.5	104	
0	851,515		35,895,755	16,079	4,168	1,164	0	14	7,490	56.2	57.2	105	
0	0	7,202,397	28,184,686	100,011	17,649	5,756	0	0	1,210	33.5	36.2	106	
736,861	181,000	3,451,074	9,282,571	29,210	3,629	1,226	1	2	5,030	52.7	55.3	107	
3,230,700	39,699,450		34,796,278	32,206	6,854	3,122	3	3	1,850	53.2	50.7	108	
7,261,434	9,142,680	2,510,328	26,654,620	(*k*) 32,802	(*l*)	5,442	3	3	2,170	(*ff*) 53.7	44.9	109	
16,865,674	13,690,981	5,960,050	17,166,883	(*k*) 49,892	(*l*)	2,791	1	2	1,220		51.8	110	
										(*ff*) 63.8	(*ee*) 59.8	111	
0	445,969,443	(*f*)	(*g*) 219,023,045							69.8	74.4	112	
										62.9	57.6	113	
										43.8	49.1	114	
0	3,637,348	0	65,381,162	54,983	6,151	967	0	2	3,110	47.4	50.2	115	
46,083,339	5,628,600		33,357,600	(*Nn*) 82,964	3,623	875	3	1	1,920		51.5	116	
(*l*)	(*l*)	757,820	13,997,366								48.5	117	
186,415,567	0	(*Pp*) 849,042,712	27,543,451							30.3	43.8	118	

1	(a)	12,000	2	67,000	252,891,600	(ww)	252,891,600	0	(t)	167,813,061	(l)	167,813,061	46,083,339
0		0	1	26,500	107,576,036		101,226,000	6,350,000	(Oo)	24,016,565	(l)	68,804,285	92,820,850	(l)	
		390,000	0	0	1,063,791,454		1,063,504,660	286,794		0	0	789,724	789,724	186,415,567	
	Totals for section		28	549,000	7	291,255	2,666,583,047	2,360,812,019	305,771,028				
	West South Central States												
84	Texas Power and Light Company		19	26,073	0	0	264,399,000	80,902,000	183,497,000				
85	Houston Lighting and Power Company		1	(a) 73,076	0	0	199,847,650	199,427,310	420,340				
86	Fort Worth Power and Light Company		1	(a) 44,000	0	0	183,622,525	183,595,700	26,825				
87	Oklahoma Gas and Electric Company		13	63,886	0	0	156,979,298	144,517,010	12,462,288				
88	Oil Belt Power Company		1	(a) 18,000	0	0	147,218,200	147,218,200	0				
89	Dallas Power and Light Company		1	(a) 35,500	0	0	144,739,433	136,323,617	8,415,816				
	Totals for section		36	461,535	0	0	1,096,806,106	.....	.....				
	Mountain States												
90	Montana Power Company		0	0	(ll) 8	227,000	1,234,052,127	1,234,052,127	0				
91	Utah Power and Light Company		3	(a) 37,040	35	(a) 159,797	744,186,000	658,479,000	85,707,000				
92	Public Service Company of Colorado		8	65,952	5	33,700	244,055,341	239,457,918	4,597,423				
93	Idaho Power Company		0	0	8	(a) 59,500	198,959,000	193,901,000	5,058,000				
	Totals for section		11	109,652	56	737,997	2,421,252,468	2,325,890,045	95,362,423				
	Pacific States												
94	Pacific Gas and Electric Company		4	(a) 142,000	28	(a) 398,975	2,001,474,640	1,623,906,794	377,567,846				
95	Southern California Edison Company		.....	214,400	.....	348,350	1,987,661,654	1,980,386,638	7,275,016				
96	Great Western Power Company		4	30,000	2	131,000	633,357,021	631,196,680	2,160,341				
97	Puget Sound Power and Light Company		8	(a) 33,350	13	(a) 138,145	632,626,358	518,463,539	114,162,819				
98	San Joaquin Light and Power Corporation		3	54,050	11	84,600	554,614,141	481,115,636	73,498,505				
99	Washington Water Power Company		0	0	7	139,750	515,523,750	490,523,000	25,000,750				
100	Los Angeles Bureau Light and Power		0	0	5	110,420	479,878,822	(jj) 182,290,040	297,588,782				
101	Portland Electric Power Company		3	(a) 36,500	6	(a) 78,730	421,155,600	420,782,200	373,400				
102	Southern Sierras Power Company (mm)		5	13,418	11	66,495	260,300,140	233,412,530	26,887,610				
103	California Oregon Power Company		.....	350	.....	(rr) 70,210	(ss) 251,310,788	(tt) 250,653,208	(uu) 443,020				
104	Seattle Municipal Light and Power System		.....	35,000	.....	65,000	218,245,950	218,245,950	0				
105	Northeastern Electric Company		2	22,500	1	12,000	196,911,791	152,212,481	44,699,310				
106	Los Angeles Gas and Electric Corporation		2	(a) 108,700	0	0	184,683,171	184,566,264	116,907				
107	Tacoma Light Department		1	11,250	1	24,000	157,662,360	144,080,485	13,581,875				
108	Pacific Power and Light Company		6	(a) 13,175	10	(a) 22,375	155,585,707	110,062,603	45,523,104				
109	Western States Gas and Electric Company		2	(ii) 11,390	3	(ii) 35,470	128,571,450	110,654,910	17,916,540				
110	San Diego Consolidated Gas and Electric Company		2	(ii) 41,540	0	0	117,956,180	109,757,430	8,198,750				
	Totals for section		42	819,728	98	1,834,125	8,897,519,523	7,842,310,388	1,055,004,575				
	Canada												
111	Hydro-Electric Power Commission of Ontario (vv)		1	15,000	21	787,854	3,298,347,874	3,116,618,428	181,729,446				
112	Shawinigan Water and Power Company		0	0	15	391,000	2,421,046,311	1,887,949,211	533,097,100				
113	Montreal Light, Heat and Power Consolidated		1	20,250	4	225,410	1,175,430,654	824,135,729	351,294,925				
114	British Columbia Electric Railway, Ltd.		1	12,500	3	113,325	336,907,650	6,265,400	330,642,250				
115	City of Winnipeg Hydro-Electric System		1	13,750	1	76,500	261,996,380	256,372,080	5,624,300				
116	Winnipeg Electric Company		1	(a) 12,000	2	67,000	252,891,600	(ww) 252,891,600	0				
117	Kaministiquia Power Company, Ltd.		0	0	1	26,500	107,576,036	101,226,000	6,350,000				
	Electric Railways												
118	Interborough Rapid Transit Company		.....	390,000	0	0	1,063,791,454	1,063,504,660	286,794				
119	Chicago Surface Lines		0	0	0	0	630,560,494	0	630,560,494				
120	Williamsburgh Power Plant Corporation		3	209,100	0	0	508,481,425	508,464,925	16,500				
121	Philadelphia Rapid Transit Company		4	63,775	0	0	385,707,158	100,999,401	284,707,757				
122	Pennsylvania Railroad Company (L.I.)		1	84,000	0	0	266,137,403	259,293,733	6,843,670				
123	Boston Elevated Railway		.....	182,000	0	0	247,490,105	247,490,105	0				
124	New York, New Haven and Hartford R.R. Company		1	53,670	0	0	209,896,000	130,646,400	78,896,000				
125	New York Central Railroad Company		2	90,000	0	0	184,775,459	184,757,639	17,820				
126	Pacific Electric Railway Company		0	0	0	0	183,000,000	0	183,000,000				
127	Twin City Rapid Transit Company		1	75,000	2	16,000	144,413,357	105,070,149	39,343,208				
128	Chicago, Milwaukee and St. Paul Ry. Company		.....	.....	.....	.....	136,993,694	0	(xx) 136,993,694				
129	Kansas City Railways Company		1	(a) 53,000	0	0	127,740,470	127,740,470	0				

(a) Kilowatts
(b) Measured at bussbar
(c) Does not include 30,000 kilowatt hydro plant at Bartletts Ferry which began operations with January 25, 1926.
(d) Includes 24,239,872 kw.-hrs joint operation with Commonwealth Edison Co.
(e) Exclusive of exciters
(f) Included under "line losses"
(g) Includes also "inter-company business"
(h) Included under "power"
(i) Includes "commercial lighting"
(j) Includes generating and substation uses and losses
(k) Includes "commercial lighting"
(l) Included under "domestic lighting"
(m) Includes "intra-company business"
(n) Included under "electric railways"
(o) Includes 6,214,350 kw.-hrs sold for street lighting, municipal light and power
(p) Includes customers of all classes
(q) Included under "residential"
(r) Includes 2,658,076 kw.-hrs used for municipal street lighting
(s) Includes 1,676,368 kw.-hrs distributed but from which no revenue was received
(t) Includes also commercial lighting and power
(u) Includes railroads
(v) Includes 39,849,100 kw.-hrs municipal street lighting
(w) Includes commercial lighting 141,007,560 kw.-hrs, private lighting 2,307 kw.-hrs municipal building lighting 7,037,327 kw.-hrs, municipal street lighting 22,948,267 kw.-hrs
(x) Does not include 184,994 kw.-hrs domestic power
(y) Includes domestic power 184,994 kw.-hrs, commercial power 490,608,163 kw.-hrs, private power 185,972 kw.-hrs, municipal power 13,074,430 kw.-hrs and miscellaneous power 419,533 kw.-hrs
(z) Includes energy used in operation and construction
(A) Includes 17,481,146 kw.-hrs for city and street lighting
(B) Includes 26,455,911 kw.-hrs for street lighting and redistribution
(C) Includes 46,364,182 kw.-hrs consumed by auxiliaries and exciters
(D) Includes 19,158,815 kw.-hrs street lighting
(E) Includes 704 municipal customers
(F) Intra-company business and all losses placed at 10.3 per cent
(G) All other distribution
(H) Includes street and commercial lighting
(I) Includes 11,370,978 kw.-hrs for municipal use
(J) Approximate
(K) Includes 2,682,908 kw.-hrs sold to municipality
(L) Includes commercial lighting, municipal sales and power
(M) Includes 18,140,774 kw.-hrs transferred to associated companies
(N) Includes small power
(O) Includes commercial other utilities
(P) Includes 9,506,373 kw
(Q) Includes 5,436,001 kw
(R) Commercial light and
(S) Retail and large light
(T) Transmission, conver
(U) Includes street lighti
(V) Includes 398,564 kw.
(W) Includes 11,007,394 k
(X) Includes 4,305,810 kw
(Y) Affiliated railways
(Z) Includes 55 municipa
(aa) Includes company ra
(bb) Includes 3,883,275 kw
(cc) Includes miscellaneou
(dd) Includes commercial
(ee) Peak load over one-h
(ff) Instantaneous peak
(gg) Peak load over 30-mi
(hh) Peak load over 5-min
(ii) Horsepower
(jj) Does not include ene
(kk) Also 12 plants with available by contract

| | | |

28	549,000	7	291,255	2,666,583,047	2,360,812,019	305,771,028								
19	26,073	0	0	264,399,000	80,902,000	183,497,000	15,920,936	(*KK*)	27,926,082	115,081,468	158,928,486	23,236,853		
1	(*a*) 73,076	0	0	199,847,650	199,427,310	420,340	15,290,963	(*MM*)	25,471,329	122,328,971	163,091,263	3,296,830		
1	(*a*) 44,000	0	0	183,622,525	183,595,700	26,825	10,323,569	(*NN*)	12,694,779	58,331,132	81,349,480	0		
13	63,886	0	0	156,979,298	144,517,010	12,462,288	18,824,840	(*OO*)	23,301,138	62,313,824	104,439,802	2,865,531		
1	(*a*) 18,000	0	0	147,218,200	147,218,200	0	152,502		152,774	30,249,168	30,554,444	0		
1	(*a*) 35,500	0	0	144,739,433	136,323,617	8,415,816	16,561,509	(*QQ*)	25,348,218	46,981,951	88,891,678	42,177,248		
36	461,535	0	0	1,096,806,106										
0	0	(*ll*) 8	227,000	1,234,052,127	1,234,052,127	0	16,548,715	(*RR*)	20,556,060	845,251,016	882,355,791	(*SS*) 128,028,433		
3	(*a*) 37,040	35	(*a*) 159,797	744,186,000	658,479,000	85,707,000	30,045,109	(*UU*)	38,797,877	508,654,430	577,497,416	53,112,634		
8	65,952	5	33,700	244,055,341	239,457,918	4,597,423	34,980,375		44,758,182	97,934,583	177,673,140	0		
0	0	8	(*a*) 59,500	198,959,000	193,901,000	5,058,000	45,655,688	(*VV*)	16,952,132	81,064,703	143,672,523	4,858,950		
11	109,652	56	737,997	2,421,252,468	2,325,890,045	95,362,423								
4	(*a*) 142,000	28	(*a*) 398,975	2,001,474,640	1,623,906,794	377,567,846	(*Aa*) 245,944,756		(*l*)	719,787,839	965,732,595	260,156,904	(*B*	
...	214,400	.....	348,350	1,987,661,654	1,980,386,638	7,275,016	71,668,826		71,240,570	1,080,421,674	1,223,331,070	297,053,231		
4	30,000	2	131,000	633,357,021	631,196,680	2,160,341	8,876,019		63,948,256	307,300,399	380,124,674	26,010,037		
8	(*a*) 33,350	13	(*a*) 138,145	632,626,358	518,463,539	114,162,819								
3	54,050	11	84,600	554,614,141	481,115,636	73,498,505	21,407,349		28,535,781	305,826,842	355,769,972	4,842,345		
0	0	7	139,750	515,523,750	490,523,000	25,000,750	(*t*) 280,982,383		(*l*)	(*l*)	280,982,383	62,321,157		
0	0	5	110,420	479,878,822	(*jj*) 182,290,040	297,588,782	(*Dd*) 164,243,926		(*l*)	(*Ee*) 230,472,025	394,715,951	0		
3	(*a*) 36,500	6	(*a*) 78,730	421,155,600	420,782,200	373,400	39,490,832		33,693,108	148,270,907	221,454,847	24,490,748		
5	13,418	11	66,495	260,300,140	233,412,530	26,887,610	3,133,566		5,516,149	164,399,819	173,049,534	0		
....	350	.....	(*rr*) 70,210	(*ss*) 251,310,788	(*tt*) 250,653,208	(*uu*) 443,020	67,402,025		7,847,659	44,396,831	119,646,515	0	(*I*	
....	35,000	.....	65,000	218,245,950	218,245,950	0								
2	22,500	1	12,000	196,911,791	152,212,481	44,699,310	10,732,935	(*Jj*)	16,374,349	133,332,139	160,439,423	0		
2	(*a*) 108,700	0	0	184,683,171	184,566,264	116,907	38,265,656		57,613,435	53,416,997	149,296,088	0		
1	11,250	1	24,000	157,662,360	144,080,485	13,581,875	(*k*) 42,891,260		(*l*)	74,293,528	117,184,788	736,861		
6	(*a*) 13,175	10	(*a*) 22,375	155,585,707	110,062,603	45,523,104	14,599,261	(*Kk*)	13,752,339	49,507,679	77,859,279	3,230,700		
2	(*ii*) 11,390	3	(*ii*) 35,470	128,571,450	110,654,910	17,916,540	(*Ll*) 20,884,925		(*l*)	62,117,463	83,002,388	7,261,434		
2	(*ii*) 41,540	0	0	117,956,180	109,757,430	8,198,750	(*Mm*) 32,766,742		(*l*)	31,505,850	64,272,592	16,865,674		
42	819,728	98	1,834,125	8,897,519,523	7,842,310,388	1,055,004,575								
1	15,000	21	787,854	3,298,347,874	3,116,618,428	181,729,446								
0	0	15	391,000	2,421,046,311	1,887,949,211	533,097,100	0		0	1,756,053,823	1,756,053,823	0		
1	20,250	4	225,410	1,175,430,654	824,135,729	351,294,925								
1	12,500	3	113,325	336,907,650	6,265,400	330,642,250								
1	13,750	1	76,500	261,996,380	256,372,080	5,624,300	78,273,217		78,596,900	36,107,753	192,977,870	0		
1	(*a*) 12,000	2	67,000	252,891,600	(*ww*) 252,891,600	0	(*t*) 167,813,061		(*l*)	(*l*)	167,813,061	46,083,339		
0	0	1	26,500	107,576,036	101,226,000	6,350,000	(*Oo*) 24,016,565		(*l*)	68,804,285	92,820,850	(*l*)		
....	390,000	0	0	1,063,791,454	1,063,504,660	286,794	0		0	789,724	789,724	186,415,567		
0	0	0	0	630,560,494	0	630,560,494	0		0	534,370	534,370	26,670,266		
3	209,100	0	0	508,481,425	508,464,925	16,500	0		0	0	0	508,481,425		
4	63,775	0	0	385,707,158	100,999,401	284,707,757	0		0	0	0	100,999,401		
1	84,000	0	0	266,137,403	259,293,733	6,843,670	0		0	0	0	266,137,403		
....	182,000	0	0	247,490,105	247,490,105	0								
1	53,670	0	0	209,896,000	130,646,400	78,896,000	0		6,875,000	0	6,875,000	20,947,000		
2	90,000	0	0	184,775,459	184,757,639	17,820	0		0	39,523,836	39,523,836	22,829,614		
0	0	0	0	183,000,000	0	183,000,000								
1	75,000	2	16,000	144,413,357	105,070,149	39,343,208								
...	.....	.....	.....	136,993,694	0	(*xx*) 136,993,694								
1	(*a*) 53,000	0	0	127,740,470	127,740,470	0	0		0	565,222	565,222	10,913,929		

(*v*) Includes 39,849,100 kw.-hrs municipal street lighting
(*w*) Includes commercial lighting 141,007,560 kw.-hrs, private lighting 2,307 kw.-hrs municipal building lighting 7,037,327 kw.-hrs, municipal street lighting 22,948,267 kw.-hrs
(*x*) Does not include 184,994 kw.-hrs domestic power
(*y*) Includes domestic power 184,994 kw.-hrs, commercial power 490,608,163 kw.-hrs, private power 185,972 kw.-hrs, municipal power 13,074,430 kw.-hrs and miscellaneous power 419,533 kw.-hrs
(*z*) Includes energy used in operation and construction
(*A*) Includes 17,481,146 kw.-hrs for city and street lighting
(*B*) Includes 26,455,911 kw.-hrs for street lighting and redistribution
(*C*) Includes 46,364,182 kw.-hrs consumed by auxiliaries and exciters
(*D*) Includes 19,158,815 kw.-hrs street lighting
(*E*) Includes 704 municipal customers
(*F*) Intra-company business and all losses placed at 10.3 per cent
(*G*) All other distribution
(*H*) Includes street and commercial lighting
(*I*) Includes 11,370,978 kw.-hrs for municipal use
(*J*) Approximate
(*K*) Includes 2,682,908 kw.-hrs sold to municipality
(*L*) Includes commercial lighting, municipal sales and power
(*M*) Includes 18,140,774 kw.-hrs transferred to associated companies
(*N*) Includes small power
(*O*) Includes commercial lighting, power, electric railways, and other utilities
(*P*) Includes 9,506,373 kw.-hrs sold to municipalities
(*Q*) Includes 5,436,001 kw.-hrs sold to municipalities
(*R*) Commercial light and power
(*S*) Retail and large light and power
(*T*) Transmission, conversion and distribution losses
(*U*) Includes street lighting
(*V*) Includes 398,564 kw.-hrs sold to leased lines
(*W*) Includes 11,007,394 kw.-hrs street lighting
(*X*) Includes 4,305,810 kw.-hrs street lighting
(*Y*) Affiliated railways
(*Z*) Includes 55 municipalities
(*aa*) Includes company railways
(*bb*) Includes 3,883,275 kw.-hrs street lighting
(*cc*) Includes miscellaneous
(*dd*) Includes commercial and power
(*ee*) Peak load over one-hour period
(*ff*) Instantaneous peak
(*gg*) Peak load over 30-minute period
(*hh*) Peak load over 5-minute period
(*ii*) Horsepower
(*jj*) Does not include energy used in generating plant
(*kk*) Also 12 plants with total generator rating of 119,205 kva. available by contract, lease of purchased energy
(*mm*) Includes also the Nevada California Power C the Desert Water Oil and Irrigation Company
(*nn*) Includes the New York Edison Company, the tric Light and Power Company, New York and Q Light and Power Company and the Westchester
(*oo*) Also included under Edison-United Compan
(*rr*) Does not include 900 kva. of the Keno Plant o leads
(*ss*) Includes 214,560 kw.-hrs not billed to compa
(*tt*) Includes Keno Plant operated under lease
(*uu*) Does not include Keno Power
(*vv*) Includes also Ontario Power Co. and Toron
(*ww*) Includes 118,006,800 kw.-hrs from Pinawa Pl peg Electric Company, 134,843,000 kw.-hrs fro Plant of Manitoba Power Company and 32,800 steam plant
(*xx*) Energy consumed
(*yy*) Includes 26,568,136 kw.-hrs municipal stree
(*zz*) Includes 23,632,532 kw.-hrs municipal sales
(*AA*) Includes sales to other utilities
(*BB*) Includes electric railways
(*CC*) Includes also electric railways and other uti
(*DD*) Includes 6,519,485 kw.-hrs municipal sales
(*EE*) Includes 5,470,430 kw.-hrs municipal sales
(*FF*) Includes 2,494,105 kw.-hrs municipal sales

23,236,853	31,607,939	12,494,722	38,131,000	50,584	12,350	2,434	5	20	2,430	(ff) 68 6	(ff) 52 2	84
3,296,830	274,366		33,185,191	44,494	8,511	3,290	1	3	2,890	(ff) 53 8	(ff) 58 0	85
0	88,131,481		14,141,564	26,512	2,383	683	0	1	2,750	(ff) 61 0	(ff) 40 7	86
2,865,531	16,954,234	2,375,865	30,343,868	55,070	10,627	3,660	5	29	1,505	(ff) 40 1	44 8	87
0	102,769,062		14,045,877	15	41	53	0	4	280,000		72 0	88
42,177,248	0		13,670,507	45,513	6,366	1,649	1	0	1,660	(ff) 73 8	(ff) 45 3	89
128,028,433	27,158,809	(f)	(g) 196,509,094	35,747	8,267	2,077	(TT) 5	13	19,150	81 8	83 5	90
53,112,634	685,828		112,930,122	77,510	10,828	3,015	6	5	6,330	67 3	75 6	91
0	10,383,519	7,215,373	48,783,309	83,957	13,077	5,447	0	14	1,735		48 1	92
4,858,950	3,628,292		46,799,235	32,907	5,091	2,007	2	5	3,590	(ff) 63 5	(ff) 59 0	93
260,156,904	(Bb) 130,225,407	51,156,669	594,203,065	(Cc) 378,225	(l)	27,518	11	24	2,380	64 1	60 2	94
297,053,231	36,169,648	1,706,630	429,401,075							(ff) 56 5	(ff) 57 3	95
26,010,037	34,991,621	(Gg) 6,273,462	(Hk) 190,273,695	31,498	13,862	11,647	11	42	6,670	67 4	58 8	96
				(p) 103,685	(q)	(q)	(q)	(q)		53 1	55 6	97
4,842,345	78,320,050	4,424,397	111,257,377	45,316	8,465	10,732	2	4	5,510	72 5	57 0	98
62,321,157	90,559,559	(f)	(g) 81,660,651	(t) 46,945	(l)	(l)	4	21	5,990	55 6	55 0	99
0	114,742	(Ff) 2,541,197		(k) 207,071	(l)	9,209	0		1,825	49 7	50 2	100
24,490,748	15,708,740	63,204,548	96,296,717	72,252	7,866	2,403	9	6	2,680	51 1	(ee) 45 6	101
0	13,715,716		73,534,890	12,546	3,432	2,035	0	7	9,600	(ff) 62 6	(ff) 59 4	102
0	(Ii) 130,039,116		53,869,647	2,835	2,943	703	0	9	7,250	54 0	42 7	103
				(p) 83,000	(q)	(q)	(q)	(q)		38 2	44 5	104
0	851,515		35,895,755	16,079	4,168	1,164	0	14	7,490	56 2	57 2	105
0	0	7,202,397	28,184,686	100,011	17,649	5,756	0	0	1,210	33 5	36 2	106
736,861	181,000	3,451,074	9,282,571	29,210	3,629	1,226	1	2	5,030	52 7	55 3	107
3,230,700	39,699,450		34,796,278	32,206	6,854	3,122	3	3	1,850	53 2	50 7	108
7,261,434	9,142,680	2,510,328	26,654,620	(k) 32,802	(l)	5,442	3	3	2,170	(ff) 53 7	44 9	109
16,865,674	13,690,981	5,960,050	17,166,883	(k) 49,892	(l)	2,791	1	2	1,220		51 8	110
										(ff) 63 8	(ee) 59 8	111
0	445,969,443	(f)	(g) 219,023,045							69 8	74 4	112
										62 9	57 6	113
										43 8	49 1	114
0	3,637,348	0	65,381,162	54,983	6,151	967	0	2	3,110	47 4	50 2	115
46,083,339	5,628,600		33,357,600	(Nn) 82,964	3,623	875	3	1	1,920		51 5	116
(l)	(l)	757,820	13,997,366								48 5	117
186,415,567	0	(Pp) 849,042,712	27,543,451							30 3	43 8	118
26,670,266	218,651	0	14,500,000							(ff) 38 6	(ee) 38 9	119
508,481,425	0	0								39 2	42 1	120
100,999,401	0	0								38 0	37 9	121
266,137,403				0	0	0	2			39 5	38 2	122
										34 3	31 2	123
20,947,000		167,456,400	14,264,000								(ee) 47 7	124
22,829,614	0	118,823,193	3,598,816							(ff) 39 7	(ee) 35 0	125
										52 7	41 8	126
										28 4		127
												128
10,913,929	343,480	(f)	(g) 115,917,839							(ff) 34 4	36 0	129

alifornia Power Company and
on Company
on Company, the United Elec-
New York and Queens Electric
the Westchester Lighting Co.
United Companies
the Keno Plant operated under

billed to company
ed under lease
ver
r Co. and Toronto Power Co.
s from Pinawa Plant of Winne-
000 kw.-hrs from Great Falls
pany and 32,800 kw.-hrs from

municipal street lighting
municipal sales
es

ys and other utilities
municipal sales
municipal sales
municipal sales

(GG) Includes 269 cooking customers
(HH) Used by company
(II) Includes 6,388,544 kw.-hrs municipal street lighting
(JJ) Includes 3,929,029 kw.-hrs municipal sales
(KK) Includes 16,077,048 kw.-hrs municipal sales
(LL) Includes 10,571,055 kw.-hrs municipal sales
(MM) Includes 12,583,647 kw.-hrs municipal sales
(NN) Includes 7,416,587 kw.-hrs municipal sales
(OO) Includes 3,589,503 kw.-hrs municipal street lighting and 1,161,086 kw.-hrs municipal power
(PP) Includes 1,385,735 kw.-hrs municipal sales
(QQ) Includes 3,838,516 kw.-hrs municipal sales
(RR) Includes 5,902,876 kw.-hrs municipal lighting
(SS) Includes 119,230,934 kw.-hrs electrified railroads
(TT) Includes 3 electrified railroads
(UU) Includes 10,802,398 kw.-hrs municipal sales
(VV) Includes 6,743,196 kw.-hrs municipal sales
(Aa) Includes also all commercial lighting, 23,775,333 kw.-hrs for heating and cooking and 20,532,740 kw.-hrs for street lighting
(Bb) Includes also 4,316,420 kw.-hrs interchange of power
(Cc) Includes also all commercial, 2,486 heating and cooking and 5,989 combination
(Dd) Includes also commercial lighting, street lighting, municipal miscellaneous, other department funds, ledger and combination rate

(Ee) Include also municipal miscellaneous, commercial miscellaneous, other department funds and sales ledger
(Ff) Includes also purpose of enterprise, light and power
(Gg) 3,249,308 kw.-hrs in hydro and steam plants, 1,823,90 kw.-hrs in transmission systems, and 1,200,248 kw.-hrs on distribution system
(Hh) 104,756,513 kw.-hrs on transmission system and 85,517,182 kw.-hrs on distribution system
(Ii) Includes also municipal sales
(Jj) Includes also 1,670,161 kw.-hrs municipal sales
(Kk) Includes also 3,247,313 kw.-hrs municipal sales
(Ll) Includes also all commercial lighting and 2,566,415 kw.-hrs for street lighting
(Mm) Includes also all commercial and 2,724,220 kw-hrs street lighting
(Nn) Includes also 6,588 fuel
(Oo) Includes also commercial lighting, electric railways and public utilities
(Pp) Includes 738,193,460 kw.-hrs used by electric railways and 110,849,252 kw.-hrs used by power houses, shops, yards, losses in conversion and used by S. Aux.
(Qq) Peak load over 15-minute period
(Rr) Alabama Power Company only